

A REVISION OF THE NORTH AMERICAN SPECIES OF HELIANTHEMUM (CISTACEAE)

(CONTINUED FROM P. 216)

H. S. DAOUD & ROBERT L. WILBUR

3. *Helianthemum canadense* (L.) Michx.

Lechea major L., Sp. Pl. 90. 1753. Type: *Clayton* (in the British Museum), not seen. Photo (GH!). "Habitat in Canadae aridis." but actually from Point Comfort, southeastern Virginia.

Cistus canadensis L., Sp. Pl. 526. 1753. Type: *Kalm* (in the Linnaean Herbarium), not seen. Photo (GH!). "Habitat in Canada."

Helianthemum canadense (L.) Michx., Fl. Bor.-Am. 1: 308. 1803. As to basionym only; Michaux's specimens were *H. Bicknellii* according to Fernald's annotated copy of Michaux's Flora at the Gray Herbarium.

Helianthemum ramuliflorum Michx., Fl. Bor.-Am. 1: 307. 1803. Type: *Michaux*. (P, not seen). "In Georgia et Carolina." Fernald's notes in the interleaved copy confirm the long-standing suspicion that this species is a synonym of *H. canadense*.

Heteromeris canadensis (L.) Spach, Ann. Sci. Nat. 2nd ser. 6: 370. 1836.

Heteromeris Michauxii Spach, Comp. Bot. Mag. 2: 291. 1837. *Nom. illegit.*, *H. ramuliflorum* Michx. cited in synonymy.

Helianthemum majus (L.) BSP., Prel. Cat. N.Y. 6. 1888.

Halimium canadense (L.) Gross., Pflanzenreich 14(IV. 193): 51. 1903.

Crocanthemum canadense (L.) Britt. & Brown, Ill. Fl. ed. 2. 2: 540. 1913.

Heteromeris major (L.) Ponzo, Nuovo Gior. Bot. Ital. n.s. 28: 169. 1921. (No basionym and probably not the species meant by Ponzo.)

Helianthemum canadense (L.) Michx. var. *sabulonum* Fern., Rhodora 43: 615. 1941. Type: *Fernald & Long 4044* (GH!) "sand dunes south of False Cape, Princess Anne County, Virginia."

Perennial herb, (6)15-45(65) cm. tall with few to many stems arising from a multicapital caudex. STEMS ascending to erect, stellate-pubescent but occasionally becoming glabrate, mostly unbranched at first anthesis, later producing numerous ascending floriferous branches. CAULINE LEAVES: petiole 1-2(3) mm. long; blade (7)18-30(38) mm. long, (3)5-7(10) mm. wide; oblance-elliptic to narrowly elliptic near the top of the stem; upper surface green and somewhat lustrous, sparsely stellate-pubescent and mostly intermixed with simple pilose

hairs 0.5-1.0 mm. long, lower surface hoary and stellate-tomentose; midvein elevated and secondary veins prominent beneath; base of blade attenuate to cuneate, apex rarely obtuse, subacute to acute; margin entire, non-revolute at first anthesis, later the upper leaves become slightly revolute. FLOWERS: dimorphic (chasmogamous and cleistogamous; maturing at different times during the growing season and occupying different positions on the plant). At first anthesis with a terminal (or subterminal), solitary, chasmogamous flower (but subsequent development of the plant leaves it in the angle of the bifurcated stem or sometimes one of the branches fails to develop and the flower appears in the axil of the branch, or even more occasionally a second or a third chasmogamous flower borne some distance above the first). Pedicel and calyx of the chasmogamous flower stellate-pubescent intermixed with apparently simple pilose hairs 0.5-1.2 mm. long and occasionally with very few red glandular hairs. Cleistogamous flowers much smaller, sessile to subsessile, (1)-few in glomerules terminating the ascending branches and also in 1-few glomerate clusters terminating the short branchlets in the leaf-axil. Pedicel and calyx of the cleistogamous flowers stellate-tomentose.

CHASMOGAMOUS FLOWERS: pedicels (1.5)4.0-9.5(17) mm. long. OUTER SEPALS (free portion) (1.2)3-5(7) mm. long, 0.5-1.0(1.2) mm. wide lanceolate or nearly so, acute; INNER SEPALS (5)6-9(10) mm. long, (3)3.5-5.0(5.6) mm. wide, ovate, acute. PETALS 8-15 mm. long, 6-14 mm. wide, yellow, obovate. STAMENS 20-35. PISTIL 1.8-3.0 mm. long; ovary 1.5-2.4 mm. long, 1-2 mm. in diameter, ovoid, glabrous; style 0.3-0.5 mm. long; stigma 0.6-1.2 mm. wide, capitate. FRUITING PEDICELS (1.5)7-12(18) mm. long. FRUITING CALYX (5)7.0-9.6(11.5) mm. long; (4.5)6-8(9) mm. in diameter, ovoid. OUTER SEPALS (free portion) (1.2)3.6-6.0(7) mm. long, (0.5)0.7-1.4(1.7) mm. wide, lanceolate or nearly so, acute; INNER SEPALS (5.0)7.0-9.6(11.5) mm. long, (3)5-7(7.7) mm. wide, ovate, acute. CAPSULE (4)6-7(8.5) mm. long, 4-7 mm. in diameter, ovoid, somewhat angled, glabrous, 3-valved (few capsules seen with 4 or 5 valves); each valve 3.5-6.6 mm. wide, ovate, acute. Funiculi and placentae persisting after the separation of valves and seeds. SEEDS 35-46, ovoid, to inequilateral, dark brown, papillate, lacking a separable membrane.

CLEISTOGAMOUS FLOWERS: either sessile or on pedicels up to 0.5 mm. long. FRUITING PEDICELS (0.5)1-2(4) mm. long. FRUITING CALYX (2.4)2.8-3.5(4.3) mm. in diameter, subglobose to globose. OUTER SEPALS (free portion) 0.2-0.4(0.6) mm. long, 0.2-0.4 mm. wide, rudimentary, knob-like, and attached to the middle edge of the inner sepals; INNER SEPALS (2.4)2.8-3.5(4.3) mm. long, (2.4)2.8-3.4(3.8) mm. wide, obliquely obovate, concave, imbricate. STAMENS 3(5). CAPSULE (2)2.3-3.0(3.8) mm. long, (2)2.5-3.0(4) mm. in diameter, ovoid-triquetrous, somewhat depressed, glabrous, 3-valved (few capsules seen with 4 valves); each valve (2)2.5-3.0(4) mm. wide, ovate-elliptic, slightly concave, some-

times laterally folded at maturity. SEEDS 5-9 (12), similar to the seeds of the chasmogamous flowers.

FLOWERING: Chasmogamous flowers, late March-July; cleistogamous flowers, May-September. HABITAT: sandy flats, dunes, "barrens", open dry woodlands, prairies, and rocky wooded slopes. DISTRIBUTION: scattered north as far as southern Nova Scotia; and from southern Maine south to southern Georgia and westward into eastern Minnesota, Iowa, and Missouri. (Map 4.)

Helianthemum canadense was the first New World species of *Helianthemum* to be described and for a very long time was thought to include as well the three other northeastern species, *H. dumosum*, *H. Bicknellii*, and *H. propinquum*. Even after their recognition as distinct entities, it has often been confused with them. *Helianthemum canadense* appears much more closely related to *H. dumosum* than to *H. Bicknellii* or *H. propinquum*. The major characteristics shared by *H. canadense* and *H. dumosum* which distinguish them from *H. Bicknellii* and *H. propinquum* are compared below.

<i>H. canadense</i> & <i>H. dumosum</i>	<i>H. Bicknellii</i> & <i>H. propinquum</i>
1. Early chasmogamous flowers typically solitary, terminal or subterminal, soon overtopped by the lateral branches.	1. Early chasmogamous flowers 2-18, rarely overtopped by the lateral branches.
2. Upper surface of cauline leaves stellate-pubescent and mostly sparsely intermixed with simple, pilose hairs 0.5-1.0 mm. long (best observed on younger leaves).	2. Upper surface of cauline leaves stellate-pubescent only.
3. Cleistogamous capsule (2.0) 2.4-3.5 (4.0) mm. in diameter each with 5-14 papillate seeds.	3. Cleistogamous capsule 1.5-2.0 (2.4) mm. in diameter each with 1-2 (3) reticulate seeds.

It is not surprising to find that *H. dumosum* was the last species to be separated from *H. canadense*. Both species have fairly uniform floral morphology (especially in the chasmogamous flowers), similar seeds, and generally similar pubescence. The major distinctions between *H. canadense* and *H. dumosum* are as follows:

H. canadense

1. Stems ascending to erect at first anthesis, and later in the growing season up to 65 cm. tall, with ascending branches and branchlets.
2. Upper surface of cauline leaves somewhat lustrous and less densely stellate-pubescent.
3. Cleistogamous flowers (1)-few in glomerules at the top of the ascending branches and on the short axillary branchlets.

H. dumosum

1. Stems relatively compact, loosely ascendent or divergent, and the plants often bushy at first anthesis, and later in the growing season up to 30 cm. tall.
2. Upper surface of cauline leaves non-lustrous and densely stellate-pubescent.
3. Cleistogamous flowers solitary, rarely two at the forks and tips of the divergent to ascending branchlets.

Helianthemum canadense and the other northeastern species, *H. dumosum*, *H. Bicknellii*, and *H. propinquum*, vary greatly in their morphological appearance during the period from first anthesis to maturity. These extreme variations cause considerable difficulty in identification. Hooker (Fl. Bor.-Am. 1: 72. 1830.) pointed out the remarkable dissimilarity between the chasmogamous and cleistogamous phases of this species which had led previous workers, including Linnaeus, to describe the latter phase as a *Lechea*. It is to be remembered though that part of the great diversity that so impressed the elder Hooker was due to the inclusion of all four northeastern or widespread eastern species within the concept of *H. canadense*.

Linnaeus included this species twice, once in its petaliferous phase as *Cistus canadensis* and again in its cleistogamous state as *Lechea major*.

Other than the remarkable floral differences, this species is morphologically rather uniform throughout its range. A few specimens, representing not more than one percent of the total number of collections examined, possessed stems branching from near the base and with the tips of the branches crowded with cleistogamous flowers. Some of these fruiting specimens had relatively longer pedicels and slightly larger capsules. Their elliptic-obovate leaves were also more crowded. Fernald (Rhodora 43: 615. 1941.) designated some specimens with these features as the new

variety *sabulonum*. Description of Fernald's variety as it appeared in Gray's Manual is quoted below in full:

Var. *sabulonum* Fern. (of sands).—Stems few, *decumbent* or *loosely ascending*; leaves *oblong-elliptic*, often canescent above; *cleistogamous* flowers mostly *long-pedicelled*, in *loose corymbs* terminating upper branches, *uniform*, in maturity 4-5 mm. in diameter.—Dunes and open sands, local, se. Mass. and Oneida L., N.Y., to se. Va.

However, the four herbarium sheets designated by Fernald as "var. *sabulonum*" show plants with 2-15, ascending to erect stems; elliptic-obovate leaves; with cleistogamous flowers borne in glomerules or rarely even in raceme-like cymes which when fruiting possess pedicels 1-4 mm. long and with capsules ranging from 2-4 mm. in diameter. In addition to the localities cited in the original description by Fernald, specimens with similar characteristics from the following localities have been examined:

St. Joseph Co., Ind., *Deam 34817* (IND); Concord, Middlesex Co., Mass., *Bartram* (PH); Manistee Co., Mich., *Schumacher* (MICH); Atlantic Co., N. J., *Fogg 13726* (PENN); Burlington Co., N. J., *Fogg 5671* (PENN); Burlington Co., N. J., *Fender 926* (PENN); Cumberland Co., N. J., *Dreisbach* (PH); Lancaster Co., Pa., *Tanger 4020* (PENN); Nansemond Co., Va., *Heller* (MIN); Isle of Wight Co., Va., *Heller* (MIN); Dane Co., Wis., *Davis* (PH); Walworth Co., Wis., *Wadmond 3133* (MIN).

Therefore, it seems that such variation occurs sporadically throughout the range of the species and that it does not represent an entity worthy of formal recognition.

REPRESENTATIVE SPECIMENS: CANADA: NOVA SCOTIA: Queens Co., Greenfield, *Weatherby & Weatherby 7120* (GH, US). ONTARIO: Comté de Carleton, Baie Constance, *Marie-Victorin, Rolland-Germain & Rouleau 6296* (FSU, MO, SMU, USF). QUEBEC: Comté de Pontiac, Ile Calumet, *Marie-Victorin, Rolland-Germain & Rouleau 58045* (GH). UNITED STATES: MAINE: Cumberland Co., Standish, *Fernald & Long 14109* (NY, PH). NEW HAMPSHIRE: Carroll Co., Conway, *Johnson 127* (ILL, UC). VERMONT: Rutland Co., Rutland, *Eggleston 1047* (GH). MASSACHUSETTS: Barnstable Co., Harwich, *Fernald 378* (COLO, DS, DUKE, F, GA, GH, IA, IND, ISC, KANU, MICH, MIN, MO, MSC, NCSC, NCU, NO, NY, OKL, PENN, SMU, TENN, UARK, UC, UMO, US, WIS, WVA); *Fernald 379* (DS, DUKE, F, GA, GH, IA, IND, ISC, MICH, MIN, NCSC, NO, NY, OKL, PENN, SMU, TENN, TEX, UARK, UC, UMO, US, WIS, WVA). RHODE ISLAND: Providence Co., Providence, June 1874, *Bennett* (CU). CONNECTICUT: Windham Co., Thompson, *Weatherby*

4926 (NCSC). NEW YORK: Queens Co., Peat Bog near Parsons Blv. & Union Turnpike, *Monachino* 142 (CHRB, CU, DUKE, ISC, OKL, SMU). PENNSYLVANIA: Bucks Co., Buckingham Mountain, ne. of Buckingham Valley, *Long* 66801 (PH). NEW JERSEY: Cape May Co., Anglesea, *Fender* 3242 (DUKE, PENN). MARYLAND: Washington Co., Warm Spring Ridge, *Shreve & Jones* 824 (US). DELAWARE: Sussex Co., 1 mi. e. of Lewes, *McVaugh* 6580 (F, GH, NY). DISTRICT OF COLUMBIA: Near Takoma Park, 27 May 1900, *Steele* (US). VIRGINIA: Isle of Wight Co., near Franklin, *Heller* 917 (CU, DS, F, GH, MIN, NY, PENN). NORTH CAROLINA: Hoke Co., 6.5 mi. nw. of Raeford, *Fox & Beaman* 4657 (NCSC, GH, NY, PH). SOUTH CAROLINA: Marlboro Co., 10.5 mi. n. of Bennettsville, *Radford* 12686 (NCU). GEORGIA: Burke Co., 1 mi. w. of Shell Bluff, *Pyron & McVaugh* 2460 (GH). WEST VIRGINIA: Hampshire Co., Loom, *Core* 3195 (SMU). KENTUCKY: Harlan Co., Pine Mountain, *Kearney* 220 (F, GH, ISC, MIN, MO, MSC, NY, US). OHIO: Lucas Co., 7 mi. nw. of Maumee, *Kriebel* 9128 (PUR). MICHIGAN: Cheboygan Co. near the Biological Station, *Gleason & Gleason* 28 (GH, IND, ISC, NY, SMU, WVA). INDIANA: Jasper Co., 2.4 mi. s. of Demotte, *Friesner* 17503 (GH, NY, UC, WVA). ILLINOIS: LaSalle Co., Starved Rock, *Greenman, Lansing & Dixon* 84 (F, GH, IA, NY, UC). WISCONSIN: Dane Co., about 4 mi. sw. of Madison, *Shinners* 1261 (UC). MINNESOTA: Washington Co., 2 mi. s. of Afton, *Moore & Moore* 13546 (GH, ISC, MIN, SMU). IOWA: Winneshiek Co., 1 mi. ne. of Hasper Twp., *Davidson & Thorne* 11161 (IA). MISSOURI: Maries Co., 3-4 mi. sw. of Belle, *Steyermack* 27590 (F).

4. *Helianthemum Coulteri* S. Wats.

Helianthemum arenicola sensu Hemsl., Biol. Centr.-Amer. Bot. 1:47. 1879. *Coulter* 743 (KEW) but not of Chapman, Fl. S. U.S. 35. 1860.

Helianthemum Coulteri S. Wats., Proc. Am. Acad. 17: 323. 1882. Type: *Coulter* 743 (GH!). Zimapán, Hidalgo, Mexico.

Cistus Virginianus Sessé & Moc., Fl. Mex. 130. 1894. Type: MA loaned to F! "in Pratis Sancti Antoni Oppid; jurisdictionis Ixtlahuacae."

Halimium Coulteri (S. Wats.) Gross., Pflanzenreich 14 (IV. 193): 46. 1903.

Halimium Berlandieri Briq., Ann. Conser. Jard. Genève 10: 99: 1907. *Berlandier* 332. (G!) Between Tampico and Real del Monte, Mexico.

Crocanthemum Berlandieri (Briq.) Janchen, Nat. Pflanzenfam. 2 ed. 21: 305. 1925.

Perennial herb or somewhat suffrutescent, 4-38 cm. tall with few to many stems arising from a caudex or occasionally a subterranean rootstock. STEMS decumbent to erect, shortly stellate-pubescent or occasionally appearing villous with simple and branched trichomes up to

1 mm. long. BASAL LEAVES mostly lacking, when present 6-24 mm. long, 2-7 mm. wide, obovate-spatulate. CAULINE LEAVES: petiole 0.6-2.0 mm. long; blade 7-45 mm. long, 2-15 mm. wide; obovate-elliptic or merely elliptic, the upper surface dark green to grayish and stellate-pubescent (sometimes sparsely intermixed with simple or stellate-pilose hairs up to 1.2 mm. long) and hoary stellate-tomentose beneath; midvein and secondary veins conspicuous and elevated beneath; base of blade attenuate to cuneate, apex obtuse to acute; margin entire, non-revolute. FLOWERS: dimorphic (chasmogamous and cleistogamous), 3-22 in number borne in a congested cyme or loosely arranged in a racemose cyme. Number of cleistogamous flowers varying in each cyme from none (in which case probably not yet formed) to eight. Bracts 1-6 mm. long, 0.2-0.8 mm. wide, linear to lanceolate. Pedicel and calyx stellate-pubescent, sometimes sparsely to densely intermixed with simple hairs up to 1 mm. long, and also with red glandular hairs occasionally present on the calyx.

CHASMOGAMOUS FLOWERS: pedicels 2.0-12 mm. long, mostly shorter than calyx. OUTER SEPALS (free portion) 2.0-4.2 mm. long, 0.4-1.0 mm. wide, linear to lanceolate; INNER SEPALS 4.0-6.5 mm. long, 3-5 mm. wide, ovate, acuminate to mucronate. PETALS 3.4-10.0 mm. long, 3.2-9.0 mm. wide, obovate, "bright yellow." STAMENS 16-30. PISTIL 1.2-3.2 mm. long; ovary 1.0-2.4 mm. long, 0.8-2.0 mm. in diameter, ovoid, glabrous; style almost wanting or up to 0.3 mm. long; stigma 0.8-1.2 mm. wide, capitate. FRUITING PEDICELS 2-12 (17) mm. long. Fruiting calyx 5-12 mm. long, 3-7 mm. in diameter, ovoid. OUTER SEPALS (free portion) 2.5-5.0 mm. long, 0.4-1.0 mm. wide, linear to lanceolate; INNER SEPALS 5-12 mm. long, 3-7 mm. wide, ovate, acuminate to mucronate. CAPSULE 3.5-7.5 mm. long, 3-6 mm. in diameter, ovoid-triquetrous, glabrous, 3-valved; each valve 3-6 mm. wide, ovate, acute, slightly concave. SEEDS 16-56, inequilateral, papillate or reticulate but then on the edges papillate, lacking a separable membrane.

CLEISTOGAMOUS FLOWERS: pedicels 1-3 mm. long, usually shorter than calyx. OUTER SEPALS (free portion) 1.2-3.0 mm. long, 0.3-0.7 mm. wide, linear; INNER SEPALS 3.0-4.5 mm. long, 2.3-2.8 mm. wide, ovate, acute. STAMENS 5(8). PISTIL 1.6-2.0 mm. long; ovary ovoid, glabrous. FRUITING PEDICELS 2-6 mm. long. FRUITING CALYX 4-7 mm. long, 3-4 mm. in diameter, ovoid. OUTER SEPALS (free portion) 2.0-4.2 mm. long, 0.3-0.7 mm. wide, linear; INNER SEPALS 4-7 mm. long, 3-4 mm. wide, ovate, acute. CAPSULE 3.0-4.5 mm. long, 2.8-4.2 mm. in diameter, ovoid-triquetrous, glabrous, 3-valved; each valve 2.8-4.2 mm. wide, ovate, acute. SEEDS 8-22, similar to the seeds of the chasmogamous flowers.

FLOWERING: March-December. HABITAT: grassy knolls, pine forest openings, dry barren open forested hilltops and moist thickets. DISTRIBUTION: southern Nuevo León to

central Veracruz in Mexico and also collected in Guatemala, Honduras and Nicaragua. (Map 12.)

The characteristic features of this species are the hoary lower surface of the leaf-blade with conspicuously elevated midvein and secondary veins, the dimorphic flowers borne in a terminal, congested cyme or racemose-cyme, and the lack (or nearly so) of the style on the chasmogamous pistil. It is the only Mexican or Central American species with papillate to reticulate seeds and also the only species from this area lacking a separable membrane.

Only three Mexican and Central American species of *Helianthemum*, *H. concolor*, *H. Coulteri*, and sometimes *H. glomeratum*, have leaves with prominent secondary veins on the lower surface. When Riley (Kew. Bull. 1923: 107.) described *H. concolor*, he indicated that it was closely related to *H. Coulteri*. However, the two species are separated geographically and they are very distinct morphologically. *Helianthemum concolor* can be readily distinguished from *H. Coulteri* by its leaves which appear bright green on both surfaces and whose lower surface is sparsely stellate-pubescent and hence the surface of the epidermis is readily visible. In contrast the densely hoary, stellate lower surface of *H. Coulteri* completely obscures the epidermis. In *H. concolor* the cleistogamous flowers are numerous in contrast to eight or fewer/cyme in *H. Coulteri*, and the inflorescence of *H. concolor* is densely covered with white but coarse stellate pubescence while that of *H. Coulteri* is covered with soft stellate pubescence intermixed with simple hairs. The seeds of *H. concolor* are smooth with a separable membrane while those of *H. Coulteri* are papillate to reticulate and lack a separable membrane.

In the southern part of its range (Guatemala, Honduras and Nicaragua), *H. Coulteri* has been either confused with *H. glomeratum* or the specimens left unidentified. *Helianthemum glomeratum* may be readily distinguished from this species by its glomerate axillary and terminal cleistogamous flowers, by its chasmogamous flowers overtopping the cleis-

togamous ones which are usually solitary at the tip of the branches and branchlets, and by its smooth seeds which possess a thin, separable membrane when moistened.

Watson (Proc. Am. Acad. 17: 323. 1882.) in his original description of this species indicated that Hemsley (Biol. Centr.-Amer. Bot. 1: 47. 1879.) had referred it to Chapman's *H. arenicola*. However, the latter species is endemic to the Gulf Coast region of the United States. The lower surface of the leaf-blade of the Gulf Coast species has obscure secondary veins and its ovary and capsule are stellate-pubescent in contrast to the prominently veined leaves and glabrous ovary of *H. Coulteri*.

Helianthemum Coulteri varies in height, shape and size of leaves, size and number of flowers, size of fruit, and sculpture of seeds through its range. Additional collections are needed before we can evaluate the significance of these variations.

The type of *Halimium Berlandieri* Briq. (G), which was most kindly loaned by the late Professor Charles Baehni, proves to be *Helianthemum Coulteri* and neither *Halimium patens* as questionably indicated by Standley (Contr. U.S. Nat. Herb. 23: 834. 1923.) nor even apparently a close relative of *Halimium Pringlei* with which Briquet compared it.

REPRESENTATIVE SPECIMENS: MEXICO: HIDALGO: between Acaxochitlán & Puebla border on road to Huauchinango, *Moore 2852* (GH, UC); District Zacualtipán Zacualtipán *Moore 2359* (GH); between Pachuca & Real del Monte, *Goodman 3408* (F, ISC). MEXICO: Sierra de las Cruces, *Pringle 6672* (F, GH, ISC, MICH, MIN, MO, MSC, ND, UC). NUEVO LEON: Sierra Madre Oriental, Alanaca to Taray, about 15 mi. sw. of Galeana, *Mueller & Mueller 980 a* (GH, MICH, TEX); Cienaguillas to Puerto Santa Ana, about 15 mi. sw. of Galeana, *Mueller & Mueller 902* (GH, MICH, TEX). PUEBLA: Honey Station, *Pringle 8804* (F, GH, MIN, MO, MSC, PH, UC); about Honey Station, *Pringle 10007* (F, GH, MIN, MO, PH, UC). SAN LUIS POTOSI: K. 50 road between San Luis Potosi & Rio V., *Layman 4169* (PH); Alvarez, Sierra de Alvarez, *Pennell 17832* (PH). VERACRUZ: Below Las Vigas, Perote, *Balls 4792* (GH). GUATEMALA: CHIMALTENANGO: Barranco de La Sierra, southeast of Patzún, *Standley 61531* (F). QUICHÉ: mountains nw. of Quiché, *Grant 699* (F, GH, MICH). HONDURAS: Morazán: western

slopes of Cerro de Uyuca, along trail from Las Flores toward Tatumbla, *Standley 22712* (F, UC); Piedra Herrada, lower slopes of Cerro de Uyuca, *Standley 11911* (F); open slopes near Haya Grande Drainage of the Rio Yeguaré, at about Long. 87° W. & Lat. 14° N., *Williams & Molina R. 13278* (F, GH); Mt. Uyuca, drainage of the Rio Yeguaré, at about Long. 87° W. & Lat. 14° N., *Glassman 1930* (F, ILL, MIN, OKL). NICARAGUA: southwest of Jinotega, along road to Cantera & Los Piños, *Standley 10076* (F).

5. *Helianthemum arenicola* Chapm.

Helianthemum arenicola Chapm., Fl. S. U.S. 35. 1860: Lectotype: *Chapman* (US #6889!). Isolectotypes: (GH, MO #788712!). "West Florida," Apalachicola.

Helianthemum canadense (L.) Michx. var. *obtusum* Wood, Class-Book 246. 1861.

Halimium arenicola (Chapm.) Gross., Pflanzenreich 14 (IV. 193): 49. 1903.

Crocianthemum arenicola (Chapm.) Barnh. in Small, Man. SE. Fl. 879. 1933.

Perennial herb 5-15(20) cm. tall with several stems arising from ascending to erect subterranean woody portion of an old stem. STEMS often partly buried in the loose sand, spreading to erect, covered with a depressed, canescent stellate pubescence. CAULINE LEAVES: petiole 0.5-2(2.4) mm. long; blade (4)8-17(28) mm. long, (1)2-4(10) mm. wide; oblanceolate to oblong to lanceolate, sometimes the lowermost spatulate; cinerous and densely stellate-pubescent, hoary and stellate-tomentose beneath; midvein elevated but the secondary veins obscure beneath; base of blade cuneate-obtuse, apex obtuse to acute. FLOWERS dimorphic (chasmogamous and cleistogamous), 2-10 in typically terminal or occasionally lateral umbellate clusters or rarely the lateral cluster reduced to a single flower. Bracts 1-3.5 mm. long, 0.3-0.6 mm. wide, linear. Pedicel and calyx stellate-canescant.

CHASMOGAMOUS FLOWERS: pedicels (2.5)5-10(16) mm. long. OUTER SEPALS (free portion) 2-4 mm. long, about 0.5 mm. wide, linear; INNER SEPALS 4-8 mm. long, 3.5-4.8 mm. wide, ovate or ovate-elliptic, acute. COROLLA yellow, petals 8-9.5 mm. long, 7.5-9 mm. wide. STAMENS 17-29. PISTIL 1.2-1.5 mm. long; ovary 1-1.2 mm. long, 0.7-1.1 mm. in diameter, ovoid, stellate-pubescent on the upper half, style 0.1-0.3 mm. long; stigma c. 0.6 mm. wide, capitate. FRUITING CALYX 5.6-8(10) mm. long, 3.6-4(5.2) mm. in diameter, ovoid-ellipsoid. CAPSULE 3.6-5.4 mm. long, 2.4-3.6 mm. in diameter, ovoid-ellipsoid, greenish, stellate-pubescent near the top, glabrous beneath, 3-valved; each valve 1.8-2.8 mm. wide, elliptic, acute, slightly concave. SEEDS 14-17, dark brown, irregular, pebbled to somewhat papillate, without a separable

membrane; cohering together in a globular or ellipsoidal mass by interwoven funiculi.

CLEISTOGAMOUS FLOWERS: pedicels 1-2 mm. long. OUTER SEPALS (free portion) 1-2 mm. long, c. 0.4 mm. wide, linear; INNER SEPALS 3.6-5.6 mm. long, 2.2-2.8 mm. wide, ovate, acute. STAMENS 4-6(8). PISTIL 1.1-1.4 mm. long; ovary ovoid, stellate-pubescent on the upper half. FRUITING CALYX 4-5.6 mm. long, 3-3.7 mm. in diameter, ovoid-ellipsoid. CAPSULE 3-4.6 mm. long, 2.4-3.4 mm. in diameter, ovoid, greenish, stellate-pubescent near the top, the lower part glabrous, 3-valved; each valve 2.2-2.7 mm. wide, ovate, acute, slightly concave. SEEDS (6)9-14, similar to those of the chasmogamous flowers.

FLOWERING: March-April. HABITAT: open, sandy scrub barrens and sand-dunes. DISTRIBUTION: near or along the beach from western Florida to Mississippi. (Map 7.)

The stellate-pubescent ovary and capsule and the typically terminal (or sometimes lateral) umbellate clusters composed of dimorphic flowers readily distinguish this species from all other North American species of *Helianthemum*.

Helianthemum arenicola is most closely related to *H. Nashii*; the two species possess the following characteristics in common: (1) the ovary and capsule stellate-pubescent; (2) the seeds dark brown, mostly coherent, pebbled to somewhat papillate and lacking a separable membrane.

In 1861 when Wood described this species as *H. canadense* var. *obtusum*, he was unaware of the previous description of Chapman's *H. arenicola*, and indicated that "It may prove distinct." In 1871 he accepted Chapman's epithet, recognizing its specific distinction and cited his variety as a synonym.

During this study four collections* were examined that seemed possible hybrids between *H. arenicola* and *H. corymbosum*. The flowers of these specimens had calyces bearing abundant simple hairs (a condition unknown in typical *H. arenicola* but characteristic of *H. corymbosum*). The chasmogamous outer sepals of these collections were relatively broad approaching those of *H. corymbosum* instead of linear as they are in *H. arenicola*. The ovaries and capsules were more nearly glabrous instead of stellate-pubescent and their cleistogamous flowers were apparently more numerous than

the few that characterize *H. arenicola*. One herbarium sheet [*Biltmore Herbarium* 5741 (NY)] has specimens of both the putative hybrid and *H. corymbosum* while Godfrey's collection from Franklin County has both the possible hybrid and the typical *H. arenicola* represented among its numerous sheets. It must be admitted that evidence of hybridization or introgression is slight and perhaps this variation is normal within the species. Field observations can do much in resolving this question. The variation appears quite comparable to the phase of *H. Nashii* that has been called *H. thyrsoides*.

*FLORIDA: Franklin Co.: very abundant, evergreen scrub-oak sand pine barrens, 1.5 miles e. of St. Theresa, 30 April 1960, *Godfrey* 59485b (DUKE); Pine palmetto woods, ½ mi. s. of Panacea, 20 March 1955, *Adams* 4 (GA). Dry sands, near the Coast, Florida, *Biltmore Herbarium* 5741 (NY). Drifting sands, near the coast of West Florida, March-April, *Biltmore Herbarium* 4028 (GH).

REPRESENTATIVE SPECIMENS: FLORIDA: Escambia Co., Pensacola, 24 Apr. 1898, *Baker* (NCU, NY); Franklin Co., near the beach, Alligator Point, *Godfrey* 53202 (DUKE, FSU, GA, IA, NCSC, NCU, NY, USF, VDB); near Appalachicola, *Curtiss* 226 (F, FLAS, GA, GH, KANU, MIN, MO, NY, OKL, PH, SMU, UARK); Gulf Co., near Port Saint Joe, *Perkins & Hall* 2440 (CU); Okaloosa Co., ½ mi. w. of Mary Esther, *Godfrey* 56668 (FSU, IA, UC, USF). ALABAMA: Baldwin Co.; Fort Morgan, *Tracy* 7787 (F, GH, ISC, MIN, MO, MSC, NY, OS, PENN, US); Mobile Co., Mobile, 20 March 1883, *Mohr* (GH). MISSISSIPPI: Harrison Co.; near Handsboro, *Channell* 1301 (VDB); Jackson Co., Horn Island, *Godfrey & Channell* 53713 (FSU, GH, NY).

6. *Helianthemum Nashii* Britt.

Helianthemum Nashii Britt., Bull. Torrey Club 22: 147. 1895. [as *H. Nashi*] Lectotype: *Nash* 815 (NY!). Isolectotypes: (CU, F, GH, MIN, MO, MSC, UC, US!). Vicinity of Eustis, Lake Co., Florida. *Halimium Nashii* (Britt.) Gross., Pflanzenreich 14 (IV. 193): 49. 1903.

Helianthemum thyrsoides Barnh. in Small, Fl. SE. U.S. 797, 1335. 1903. Type: *Barnhart* 2740 (NY!). Sutherland, Florida.

Crocianthemum thyrsoides (Barnh.) Janchen, Nat. Pflanzenfam. ed. 2. 21: 307. 1925.

Crocianthemum Nashii (Britt.) Barnh. in Small, Man. SE. Fl. 879. 1933.

Perennial herb (14)25-30(41) cm. tall with few to numerous decumbent to ascending or more commonly erect, depressed stellate-

tomentulose stems arising from a caudex or from a subterranean horizontal rootstock. CAULINE LEAVES: petioles (0.6)1-2(3) mm. long; blade (5)23-27(38) mm. long, (0.9)3.8-5.7(8.4) mm. wide; oblance-elliptic on the lower half of the stem and becoming elliptic-lanceolate near the apex; densely stellate-canescens above and hoary and stellate-tomentose beneath; midvein elevated and the secondary veins but very slightly to moderately elevated beneath; base of blade cuneate, apex obtuse to acute; margins entire, slightly revolute. INFLORESCENCE: an elongate, leafy thyrse. FLOWERS dimorphic (chasmogamous and cleistogamous) in each cymule. Bracts 1-3.2 mm. long, 0.2-0.6 mm. wide, linear-lanceolate. Pedicels and calyx stellate-canescens or stellate-canescens intermixed with abundant hirsute trichomes about 0.7-1.5 mm. long.

CHASMOGAMOUS FLOWERS: pedicels (2)3-8(10) mm. long. OUTER SEPALS (free portion) 1-2.5(3) mm. long, 0.2-0.4 mm. wide, linear; INNER SEPALS 3.5-5.0 mm. long, 2.7-3.7 mm. wide, obliquely ovate-elliptic. COROLLA yellow, petals 5-9.4 mm. long, 3-6.6 mm. wide, broadly cuneate. STAMENS 12-18. PISTIL 1-1.8 mm. long; ovary 0.8-1.5 mm. long, 0.8-1.3 mm. in diameter, ovoid, stellate-pubescent; style 0.2-0.3 mm. long; stigma 0.4-0.7 mm. wide, capitate. FRUITING PEDICELS 3.6-7.2(12) mm. long. FRUITING CALYX 4-5.5 mm. long, 3.8-4.6 mm. in diameter, ovoid to nearly globose. CAPSULE 3-4.8 mm. long, 2.4-3.8 mm. in diameter, broadly ovoid, elliptic in cross-section, apex blunt, stellate-pubescent on the upper half, gradually becoming glabrous on the lower half, 2-valved; each valve 2.4-3.8 mm. wide, broadly ovate, obtuse, concave. SEEDS 6-10, dark brown, irregular, cohering together into a globular mass by the interwoven funiculi, pebbled to somewhat papillate and lacking a separable membrane.

CLEISTOGAMOUS FLOWERS: pedicels 0.5-2.4 mm. long. OUTER SEPALS (free portion) 0.5-1.2 mm. long, c. 0.5 mm. wide, linear; INNER SEPALS 0.5-3.4 mm. long, 1-2.3 mm. wide, obliquely ovate-elliptic. STAMENS 5(7). OVARY ovoid, stellate-pubescent. FRUITING PEDICELS 1.5-4.5 mm. long. FRUITING CALYX 3-3.6 mm. long, 2.4-3.6 mm. in diameter, ovoid. CAPSULE 3-4 mm. long, 2.4-3.5 mm. in diameter, otherwise similar to the chasmogamous capsule. SEEDS 5-8, similar to those of the chasmogamous flowers.

FLOWERING: March-June. HABITAT: sand dunes and dry sandy pine woods and scrub. DISTRIBUTION: peninsular Florida. (Map 7.)

The elongate, leafy, thyrsoïd inflorescence and the bicarpellate, stellate-pubescent ovary and capsule make *H. Nashii* most distinctive.

This species and *H. arenicola* are the only New World

species of *Helianthemum* with stellate-pubescent ovaries and capsules. It appears that *H. Nashii* is the only species of *Helianthemum* with a typically 2-valved capsule (or in any event, it is certainly the only North American species). Apparently all other species of Cistaceae characteristically have a 3 or 5-10-valved capsule.

Barnhart (in Small, Fl. SE. U.S. 797, 1335. 1903.) described *H. thyrsoides* as a new species. In 1933 (in Small, Man. SE. Fl. 880.) he transferred it to the segregate genus *Crocanthemum* overlooking the fact that Janchen had made the transfer eight years earlier. The species was there described as follows:

"6. *C. thyrsoides* Barnhart. Plant similar to *C. Nashii* in habit, but the inflorescence less widely branched, and the sepals densely hirsute."

We have seen perhaps a dozen specimens fitting these characteristics including the type of Barnhart's species. The only difference noted between *H. thyrsoides* and *H. Nashii* was the presence of the hirsute hairs on the calyx of the former species. The variant with a hirsute calyx is known from Orange, Pinellas, Polk and Seminole Counties where the form with short-pubescent calyces is also to be found. There is no distinct geographic or ecologic range of these forms and both have been collected within the same stand. Therefore Barnhart's species, *H. thyrsoides*, is here treated as a synonym of *H. Nashii*. There is a similar variant of the closely related *H. arenicola*, but in that species there seems to be some slight evidence that the hirsute calyces might be due to introgression from *H. corymbosum*. In *H. arenicola*, that possibly was introgressed by *H. corymbosum*, the ovary or capsules were less pubescent and the bracts seemed to vary somewhat in the direction of *H. corymbosum*.

REPRESENTATIVE SPECIMENS: FLORIDA: Brevard Co., west of Eau Galle, *Hood 4305* (FLAS); Collier Co., Marco Island, 15 April 1954, *West, Arnold & Cooley* (FLAS); Duval Co., Jacksonville and vicinity, 1875, *Hogg* (NY); Hernando Co., at Weekiwachee Springs, *Cooley & Eaton 6602* (FSU, USF); Highlands Co., Avon Park, *Small 12662* (USF); Lake Co., Vicinity of Eustis, *Nash 815* (CU, F, GH, MIN,

MO, MSC, NY, US); Levy Co., Cedar Key, *Godfrey 56603* (IA, FSU, UC, USF, VDB); Manatee Co., Bradentown, 10 May 1936, *Cuthbert* (FLAS); Martin Co., near Darkeytown, 31 Jan. 1917, *Atwood* (CU); Orange Co., Windermere, *Blanton 6506* (US); Osceola Co., Kissimmee, *Singeltary 218* (DUKE, NCSC); Palm Beach Co., just n. of Delray, 18 March 1945, *Fox* (NCSC, WVA); Pinellas Co., Gulfport, *Schallert 3995* (SMU); Polk Co., Dear Lake scrub, *McFarlin 5177* (MICH); Putnam Co., south end of Reserve Welaka, 19 June 1941, *Laessle* (FLAS); Seminole Co., at Sanford, *Godfrey, Eaton & Ray 7547* (USF).

7. *Helianthemum Bicknellii* Fern.

Helianthemum canadense (L.) Michx. var. *Walkerae* Evans, Bot. Gaz. 15: 211. 1890. Lectotype: *Walker* (US!) Douglas Co., Colorado.

Helianthemum majus in sense of Bickn., Bull. Torrey Club 21: 259. 1894 but not of the basionym *Lechea major* L., Sp. Pl. 90. 1753, whose type was found to be conspecific with *Cistus canadensis* L.; nor *Helianthemum majus* (L.) BSP., Prel. Cat. N.Y. 6, 1888, a nomenclatural transfer (covering all northeastern entities) based on page priority.

Halimium majus in sense of Gross., Pflanzenreich 14 (IV. 193): 50. 1903.

Crocanthemum majus Britt. in Britt. & Brown, Ill. Fl. ed. 2. 2: 540. 1913.

Helianthemum Bicknellii Fern., Rhodora 21: 36. 1919. Type: *Fernald*, 7 August 1908 (GH!). Bangor, Maine.

Heteromeris major in sense of Ponzo, Nuovo Gior. Bot. Ital. n.s. 28: 169. 1921. (No basionym cited.)

Crocanthemum Bicknellii (Fern.) Janchen, Nat. Pflanzenfam. ed. 2. 21: 307. 1925.

Helianthemum Walkerae (Evans) Lyon, [as *Walkedae* and without basionym or even indication that a new combination was being made], Am. Midl. Nat. 12: 278. 1927.

Perennial herb, (12)20-46(67) cm. tall with many clustered stems arising from a multicipital caudex. Stems ascending to erect, stellate-pubescent, simple or sparsely branched at first anthesis; branches moderately ascending to appressed, restricted to the upper third of the stem, later in the growing season becoming densely leafy and crowded with cleistogamous flowers. CAULINE LEAVES: petiole 1-3(4) mm. long; blade (8)18-32(40) mm. long, (2)4-7(10.5) mm. wide; oblance-elliptic to elliptic, green and stellate-pubescent above, hoary stellate-tomentose beneath; base of blade cuneate, apex subacute to acute; margin entire, the upper cauline leaves slightly revolute; midvein and secondary veins prominent beneath. FLOWERS dimorphic (chasmogamous and cleistogamous); maturing at different times during the growing season and upon different positions on the plant. At first anthesis with (2)6-10(18) chasmogamous flowers terminating

the stem and the uppermost branches in a cymose cluster and these rarely surpassed by the lateral branches at maturity. Pedicel and calyx of the chasmogamous flowers densely covered with stellate pubescence and with apparently simple (although mostly unequally stellate), pilose hairs. Bracts 3-7 mm. long, 0.5-1 mm. wide, lanceolate. Later in the growing season the lateral, ascending to depressed, leafy branches becoming crowded with sessile to subsessile cleistogamous flowers in axillary and terminal glomerules. Pedicels and calyces of the cleistogamous flowers stellate-pubescent.

CHASMOGAMOUS FLOWERS: pedicels (1.2)3-8(12) mm. long, mostly shorter than calyx. OUTER SEPALS (free portion) (2.4)3.5-4.5(8) mm. long, nearly as long as the inner ones, 0.4-1.0 mm. wide, linear, acute; INNER SEPALS (3.4)5-7(8) mm. long, 2.4-4.0 mm. wide, ovate-elliptic, acute. PETALS 8-12 mm. long, 5-10 mm. wide, obovate. STAMENS (18)26-38. PISTIL 1.5-2.6 mm. long; ovary 1.0-1.6 mm. long, 0.8-1.4 mm. in diameter, ovoid, glabrous; style 0.4-0.8 mm. long; stigma 0.6-0.8 mm. wide, capitate. FRUITING CALYX (4.5)5.2-7.2(9.6) mm. long, (3.4)4.0-5.5(6.5) mm. in diameter, ovoid. CAPSULE (2.4)3.5-5.0(5.6) mm. long, (2.2)3.0-4.0(5.0) mm. in diameter, ovoid-triquetrous, sometimes abruptly short-pointed; 3-valved (but a few capsules seen with 4 or 5 valves); each valve (2.2)3.0-4.0(4.4) mm. wide, ovate-elliptic, acute, slightly concave. SEEDS 12-26, ovoid to inequilateral, brown-spotted and indistinctly reticulate with very slight relief.

CLEISTOGAMOUS FLOWERS: sessile to subsessile. FRUITING PEDICELS 0.4-0.7(1.3) mm. long. FRUITING CALYX 1.7-2.5(3.0) mm. long, 1.6-2.2(2.5) mm. in diameter, ovoid. OUTER SEPALS (free portion) (0.3)0.6-1.2(1.8) mm. long, 0.2-0.3 mm. wide, linear; INNER SEPALS 1.7-2.5(3.0) mm. long, 1.5-2.3 mm. wide, ovate-elliptic, acute. STAMENS 3(5). CAPSULE 1.5-2.2(2.8) mm. long, 1.2-2.0(2.4) mm. in diameter, ovoid-triquetrous, apiculate, glabrous, 3-valved (few capsules seen with 4-valves); each valve 1.2-2.0(2.4) mm. wide, ovate-elliptic, acute, slightly concave, mostly dehiscing for about two-thirds distance towards base and spreading at maturity. SEEDS 1-2(3), globose (when one seed per capsule), half globose (when two), or three-sided with the outer convex (when three per capsule), obscurely reticulate with low relief and reddish brown.

FLOWERING: chasmogamous flowers, June-July; cleistogamous flowers, July-September. HABITAT: sandy and rocky shores, sand dunes or barrens, open dry sandy fields or prairies, and open mountain tops. DISTRIBUTION: Maine to northern Georgia and westward into Minnesota, eastern Wyoming, and Colorado. (Map 6).

H. Bicknellii has a wider distribution and has been more

extensively collected than any North American *Helianthemum*. This species is rather uniform throughout its range excepting perhaps some specimens from Colorado which show somewhat wider cauline leaves on the lower half of the stem. However, this species has a remarkably different appearance from first anthesis, when the chasmogamous flowers terminate the stem and whose fruits drop as soon as they mature, to the end of the growing season when the branches are crowded with the mature cleistogamous fruits. This extreme variation causes difficulty in identification.

The species with which *H. Bicknellii* is most easily confused is *H. propinquum* and they were in fact judged conspecific by Blake (*Rhodora* 20: 50. 1918.). Fernald (*Rhodora* 21: 36-37. 1919.), after considerable field study was finally convinced of their specific differences. *Helianthemum propinquum* shares with *H. Bicknellii* the following characteristics: (1) chasmogamous flowers in a terminal cymose cluster; (2) cleistogamous flowers sessile to subsessile and borne on the branches in axillary and terminal glomerules; (3) cleistogamous capsules 1.5-2.0 (2.4) mm. in diameter each with 1-2 (3) reticulate seeds.

Despite the close similarity between the two, they may be readily distinguished as follows:

H. Bicknellii

1. Chasmogamous outer sepals fused with the inner sepals near the base and its free portion more than half the length of the inner sepals.
2. Base of leaf-blade cuneate.
3. Usually stems arising from a multicapital caudex.
4. Fruiting cleistogamous outer sepals more than 3-times longer than wide.
5. Cleistogamous capsule ovoid-triquetrous.

H. propinquum

1. Chasmogamous outer sepals fused for up to two thirds of the length of inner sepals and its free portion half of the length or less of the inner sepals.
2. Base of leaf-blade attenuate.
3. Stems arising from subterranean rootstocks.
4. Fruiting cleistogamous outer sepals about twice longer than wide (knob-like and attached to the middle edge of the inner ones).
5. Cleistogamous capsule ovoid or nearly so.

There has been much confusion concerning the nomenclature of this species and it therefore seems desirable to discuss it briefly. Prior to 1894 the taxon now known as *H. Bicknellii* had been erroneously equated with *H. canadense* or treated as a named or unnamed variant. Gray (Man. Bot. N. U.S. 47-48. 1848.) treated plants belonging to this species under *H. canadense* as follows: "A variety is more hoary, and with a stronger tendency to multiply the minute clustered flowers." Evans (Bot. Gaz. 15: 211. 1890.) described this taxon as *H. canadense* var. *Walkerae* basing his description upon specimens from Colorado. Bicknell (Bull. Torrey Club 21: 257-260. 1894.), studying the genus in the vicinity of New York, recognized two distinct species. The first was *H. canadense* and the second and the more common species of the two, he referred to "*H. majus* (L.)" stating:

"As a matter of fact, however, the apetalous state of true *H. Canadense* Michx., as here defined, does not closely resemble a *Lechea*, while the corresponding state of the newly recognized species is, in a marked degree, suggestive of a plant of that genus. . . . It would appear, therefore, not at all improbable that the *Helianthemum* described by Linnaeus as *Lechea major* was in reality the plant here in view, and that his *Cistus Canadensis* was after all a different plant. An examination of the type specimens in the Linnaean herbarium can alone settle the question, and may prove that the plant here called *majus* requires a different name; but for the purpose of more easily handling the plants in this note, I adopt provisionally the name *H. majus* (L.), for the newly recognized plant. . . ."

Therefore from 1894 to 1918 this species was known as *Helianthemum majus* or *Crocanthemum majus*. Blake's (Rhodora 20: 49+50. 1918.) examination of the Linnean specimens demonstrated that *Lechea major* L. was conspecific with *Cistus canadensis* as had already been suggested by Elliott, Torrey and Gray, and Hooker. Blake concluded that the plant to which Bicknell applied the name was conspecific with *H. propinquum*. Fernald (Rhodora 21: 36+37. 1919.) indicated that *Helianthemum majus* in the sense of

Bicknell (not *H. majus* (L.) BSP, a synonym of *H. canadense* maintained under the American Code due to page priority) was a "good" species amply distinct from *H. propinquum* and he provided the new name *Helianthemum Bicknellii*.

Specimens from northeastern Sonora reported by White (Lloydia 11: 287. 1948.) as this species (under the name *H. majus*) are *H. Pringlei*.

REPRESENTATIVE SPECIMENS: CANADA: MANITOBA: Brokenhead, 12 mi. north of Beausejour, *Scoggan 11550* (MIN). ONTARIO: Essex Co., Windsor, *Macoun 34070* (GH, MO, NY, US). UNITED STATES: MAINE: Penobscot Co., Orono, *Fernald 336* (A, GH, MIN, MO, MSC, NY, PH, US, WIS). NEW HAMPSHIRE: Cheshire Co., Walpole, *Fernald 88* (GH). VERMONT: Bennington Co., Pownal, 10 Oct. 1857, *Ames* (MICH). MASSACHUSETTS: Barnstable Co., Harwich, *Fernald & Long 382* (DS, DUKE, F, GA, GH, IA, IND, ISC, KANU, MICH, MIN, MO, NO, NY, OKL, PENN, SMU, TENN, TEX, UARK, UC, UMO, US, WIS). RHODE ISLAND: Washington Co., Prudence Island, Narragansett Bay, *Mearns 384* (US). CONNECTICUT: New London Co., behind dunes, Bluff Point, Groton, *Travis 2022* (PENN). NEW YORK: Cayuga Co., sandy crest of Salmon Creek Ravine, Genoa, *Wiegand 10304* (CU, GH). PENNSYLVANIA: Lancaster Co., about the mouth of the Tucquan, 24 July 1901, *Heller* (CU, F, GH, IND, MO, US). NEW JERSEY: Passaic Co., Wanaque, *Mackenzie 2710* (MO, NY). DELAWARE: New Castle Co., Serpentine e. of Mount Cuba, *Pennell 1499* (PENN). MARYLAND: Cecil Co., drainage of Octoraro Creek, e. of Rocksprings, *Long 28484* (GH, PH). VIRGINIA: Arlington Co., Tarrison, *Steele 391* (F, NY). NORTH CAROLINA: Ashe Co., near top of Nigger Mountain, *Fox & Godfrey 3347* (FSU, GA, GH, NCSC, US); Buncombe Co., summit of Cedar Cliff Mountain, *Biltmore Herb. 5740b* (F, GH, MO, NY, US). GEORGIA: Towns Co., on summit at Enotah Bald Mountain, Brasstown Bald, *Pyron 521* (GA). OHIO: Wayne Co., Shreve, *Duvel 804* (NCU, OS). KENTUCKY: Meade Co., without exact locality, 1842, *Short* (PH). TENNESSEE: Blount Co., edge of "bald", Gregory Bald, *Wilson 1941* (TENN); Knox Co., Knoxville, *Moldenke 10705* (NY). MICHIGAN: Menominee Co., Menominee, *Grassl 2886* (MICH, NY). INDIANA: Lagrange Co., 3 mi. e. of Mongo, *Yunker & Welch 10782* (COLO, GH, SMU). WISCONSIN: Greene Co., 5 mi. ese. of Monticello, *Iltis & Greene 6720* (MIN, WIS). ILLINOIS: Lake Co., n. of Waukegan and e. of the glacial Glenwood Ridge, *Gates 2752* (F, ILL, MICH). MINNESOTA: Hubbard Co., roadside to Park Rapids, *Moyle 759* (CU, GH, IND, NY, US). IOWA: Guthrie Co., 12 mi. n. of Adair, *Fay 5310* (KANU, UC, US). MISSOURI: Barry Co.: Eagle Rock, *Bush 197* (GH, MO, NCU, NY, US). ARKANSAS: Hempstead Co., Washington City, *collector unknown* (MO). SOUTH DAKOTA: Custer Co., Black Hills,

Rydberg 542 (NY, US). NEBRASKA: Brown Co., Long Pine, *Clements 2940* (CU, ISC, NY, US). COLORADO: El Paso Co., Black Forest, *Livingston 640* (DUKE).

8. *Helianthemum propinquum* Bickn.

Helianthemum propinquum Bickn., in Britton Man. Fl. N. U.S. ed. 2. 1069. 1905. Type: *Bicknell*, August 1903 (NY!). Valley Stream, Long Island, New York.

Helianthemum georgianum sensu Britt. in Britt. & Brown, Ill. Fl. ed. 2. 2: 540. 1913.

Crocanthemum propinquum (Bickn.) Bickn., Bull. Torrey Club 40: 615. 1913.

Perennial herb, 8-27(35) cm. tall with few to many stems arising usually singly at intervals (or sometimes few together) from a horizontal, subterranean rootstock. STEMS slender, ascending to erect, stellate-tomentose, somewhat reddish when young, mostly simple at first anthesis; branches ascending, mostly restricted to the upper half of the stem, densely leafy late in the season and becoming congested with cleistogamous flowers. CAULINE LEAVES: petioles (1)2-4(5) mm. long; blade (5)12-28(37) mm. long, (1.5)3-6(10) mm. wide; oblanceolate to narrowly oblance-elliptic; dark green and stellate-pubescent above, hoary stellate-tomentose beneath; midvein and secondary veins prominent beneath; base of blade attenuate, apex obtuse to acute; margin entire, sometimes the upper leaves slightly revolute. FLOWERS dimorphic (chasmogamous and cleistogamous); maturing at different times during the growing season and upon different positions on the plant. At first anthesis with 2-6 chasmogamous flowers terminating the stem in a cymose cluster and these surpassed by the lateral, ascending, leafy branches densely crowded with sessile to subsessile cleistogamous flowers in axillary and terminal glomerules. Bracts subtending chasmogamous flowers 1.5-3.5 mm. long, 0.2-0.4 mm. wide, lanceolate. Pedicel and calyx covered with appressed, densely matted, elongate stellate-pubescent.

CHASMOGAMOUS FLOWERS: pedicels (2)8-14(22) mm. long, mostly longer than calyx. OUTER SEPALS: fused with 1/2-2/3 of the edge of the inner sepals, free portion (0.7)1.5-3.0(4.0) mm. long, 1/3-1/2 the length of the inner sepals, 0.4-0.9 mm. wide, linear; INNER SEPALS (4)5.0-7.5(8) mm. long, 2.3-4.5 mm. wide, ovate, acute. PETALS 7.5-10.0(13.5) mm. long, 6-12 mm. wide, obovate. STAMENS 24-30, "anthers orange" (*fide Fernald 17160*). PISTIL 2.0-2.6 mm. long; ovary 1.5-1.8 mm. long, 1.0-1.4 mm. in diameter, ovoid, glabrous; style 0.5-0.8 mm. long; stigma 0.6-0.8 mm. wide, capitate. FRUITING CALYX (5)6-8(9.7) mm. long, 3.5-7.0 mm. in diameter, ovoid. CAPSULE 3.7-5.3 mm. long, 3-4 mm. in diameter, ovoid-triquetrous, glabrous, 3-valved (but a few capsules seen with 4 or even 5 valves); each valve (1.2)2.2-3.7 mm. wide, ovate-elliptic; capsules usually overtopped by the upper branches

and mostly falling promptly after maturity. SEEDS 12-15, ovoid to inequilateral, brown-spotted, reticulate or sometimes somewhat papillate at the edges only.

CLEISTOGAMOUS FLOWERS: sessile to subsessile. FRUITING PEDICELS up to 1.5 mm. long. FRUITING CALYX 2.0-2.5 (2.7) mm. long, 1.5-2.2 (2.5) mm. in diameter, ovoid to subglobose. OUTER SEPALS (free portion) 0.2-0.5 mm. long, 0.2-0.3 mm. wide, rudimentary, knob-like, attached at the middle edge of the inner sepals; INNER SEPALS 2.0-2.5 (2.7) mm. long, 1.5-2.2 mm. wide, ovate, acute, somewhat lustrous. STAMENS 3-4. CAPSULE 1.5-2.2 mm. long, 1.3-2.0 mm. in diameter, ovoid and usually rounded in cross-section (rarely weakly ovoid-triangular), glabrous, 3-valved; each valve 1.1-1.8 mm. wide, ovate-elliptic, subacute to acute, never spreading at maturity. SEEDS 1-2 (3), globose (when one seed per capsule), half globose (when two), and three-sided with the outer side convex (in three-seeded capsule), brown-spotted and reticulate.

FLOWERING: Chasmogamous flowers, late May-early July; cleistogamous flowers, July-September. HABITAT: fields, sandy places and dry, open woods. DISTRIBUTION: Eastern Massachusetts southward through eastern Pennsylvania to northern Virginia; also collected from the mountains of North Carolina, Tennessee and northern Georgia. (Map 5.)

Previously, *H. propinquum* was believed to occur only from eastern Massachusetts southward to the District of Columbia. However, this species also occurs in the mountains of western North Carolina, eastern Tennessee and northern Georgia where it has usually been misidentified as *H. Bicknellii*.

The species with which *H. propinquum* is most likely to be confused is *H. Bicknellii*, as was done by Blake (*Rhodora* 20: 49 + 50. 1918.). The characteristics which these species have in common, as well as those which serve to distinguish them from each other, are indicated under the discussion of *H. Bicknellii*.

Prior to its original description in 1905, *H. propinquum* was referred to as a stunted form of *H. canadense*. The clustered, chasmogamous flowers with calyces covered with appressed stellate pubescence, the 1-2 (3)-seeded, cleistogamous capsule, and the stem which arises from subterranean rootstock, readily distinguish this species from both *H. canadense* and also from *H. dumosum*. However, *H. propin-*

quum resembles *H. canadense* in having somewhat lustrous cleistogamous fruiting calyces and in having outer sepals which are rudimentary or knob-like and attached to the middle edge of the inner sepals.

Britton (in Britt. & Brown, Ill. Fl. ed. 2. 2: 540. 1913.) equated this species with *H. georgianum* which is morphologically quite unlike it and which has a very different range.

REPRESENTATIVE SPECIMENS: MASSACHUSETTS: Barnstable Co., Harwich, *Fernald 380* (DS, DUKE, F, FLAS, FSU, GA, GH, IA, IND, ISC, KANU, MICH, MIN, MO, MSC, NCSC, NCU, NO, NY, OKL, PENN, SMU, TENN, UARK, UC, UMO, US, WIS, WVA); Brewster, *Fernald 381* (DS, DUKE, F, FLAS, GA, GH, IA, IND, ISC, KANU, MICH, MIN, MSC, NCSC, NCU, NO, NY, OKL, PENN, SMU, TENN, TEX, UARK, UC, UMO, US, WIS, WVA). CONNECTICUT: Hartford Co., Southington, *Bissell 88* (GH). NEW YORK: Nassau Co., Valley Stream, August 1903, *Bicknell* (NY). PENNSYLVANIA: Bucks Co., Turkey Hill, *Long 21299* (PH). NEW JERSEY: Morris Co., Succasunna, *Mackenzie 4104* (MO, US). DELAWARE: Sussex Co., e. of Ellendale, *Pennell 12884* (MINN, US). MARYLAND: Cecil Co., 2 mi. w. of Elkton, *Randolph & Randolph 128* (CU, GH). DISTRICT OF COLUMBIA: Pinehurst, 3 June 1919, *Steele* (F, GH, NY). VIRGINIA: Arlington Co., Arlington Forest, *Balls 7804* (US). NORTH CAROLINA: Ashe Co., Bald, Nigger Mountain w. of West Jefferson, *Radford 41133* (NCU); Avery Co., 0.6 mi. ne. of Avery-Mitchell Co. line on US 19E., *Ahles & Duke 43433* (NCU); Buncombe Co., Biltmore, *Biltmore Herbarium 1217* (CU, MIN, US); Henderson Co., Flat Rock, *Schallert 8645* (DUKE); Stokes Co., 1.5 mi. n. of Belews Creek, *Radford 34511* (NCU); Transylvania Co., behind Pisgah Inn, Mt. Pisgah, *Oosting 1779* (DUKE, FLAS, PH). TENNESSEE: Coffee Co., 10 mi. ne. of Tullahoma, *Hardin 15761* (TENN); Cumberland Co., near Crossville, *Rhoades 19* (CU); Monroe Co., near Mt. Vernon, *Ford & Russell 2097* (SMU, TENN). GEORGIA: without locality "Northern Georgia, chiefly of the Mts. & upper Country, 1878" *Vassey* (PH).

9. *Helianthemum Greenei* Robins.

Helianthemum occidentale Greene, Bull. Calif. Acad. Sci. 2: 144. 1886.

Type: *Greene*, July & August 1886 (ND!), isotype (NY!) "on dry summit in the central part of the Island of Santa Cruz, Santa Barbara Co., California; not Nym., Consp. Fl. Eur. 72. 1878.

Helianthemum Greenei Robins., Syn. Fl. N. Am. 1(1): 191. 1895. (nom. nov. for Greene's later homonym).

Halimium occidentale (Greene) Gross., Pflanzenreich 14 (IV. 193): 35. 1903.

Crocanthemum occidentale (Greene) Janchen, Nat. Pflanzenfam. ed. 2. 21: 305. 1925.

Suffruticose perennial, often somewhat spartioid, 14-30 cm. tall with few stems arising from a woody caudex. STEMS: ascending to erect, moderately branched, and varying from sparsely to densely finely stellate-pubescent; the pubescence below the inflorescence usually of dark, capitate glandular trichomes about 0.4-0.6 mm. long. LEAVES sessile or with petioles up to 3 mm. long; blade 7-30 mm. long, 0.8-4.0 (5.0) mm. wide, oblanceolate-elliptic to linear-lanceolate near the top of the plant, green and stellate-pubescent on both surfaces; midvein prominent and secondary veins obscure beneath; base of blade attenuate to cuneate, apex acute; margin entire and sometimes slightly revolute. INFLORESCENCE: corymbose to short-paniculate. FLOWERS isomorphic (all chasmogamous). Inflorescence with sparse to dense stellate pubescence intermixed with coarse, red, glandular hairs mostly 0.4-0.6 mm. long. Bracts 3-10 mm. long, 0.5-1.5 mm. wide, lanceolate and nearly same shape as the outer sepals.

CHASMOGAMOUS FLOWERS: pedicels 0.5-4.0 (6.0) mm. long, usually shorter than calyx. CALYX with simple, white, villous trichomes about 0.8-1.5 mm. long intermixed with fewer, shorter (c. 0.2-0.4 mm.) dark reddish, capitate glandular trichomes. OUTER SEPALS (free portion) 2.5-4.0 mm. long, 0.5-1.0 mm. wide, lanceolate; INNER SEPALS 4.5-7.0 (8.0) mm. long, 3-4 mm. wide, ovate, acuminate. PETALS 5-8 mm. long, 3-4 mm. wide, obovate, yellow. STAMENS 20-25. PISTIL 1.8-2.2 mm. long; ovary 1.2-1.4 mm. long, 0.8-1.0 mm. in diameter, ovoid, glabrous; style 0.5-0.7 mm. long; stigma 0.4-0.6 mm. wide. FRUITING CALYX 4.5-8.0 mm. long, 3.5-4.0 mm. in diameter, ovoid. CAPSULE 4.3-6.0 mm. long, 3.0-3.5 mm. in diameter, ovoid, glabrous, 3-valved, each 3.0-3.5 mm. wide, ovate-elliptic, acute. SEEDS c. 15, inequilateral and the thin membrane readily separating when seeds moistened.

FLOWERING: April-May. HABITAT: dry rocky ridges. DISTRIBUTION: Known only from certain islands off the southern California coast. (Santa Catalina, Santa Cruz and Santa Rosa Islands). (Map 10.)

This species is readily distinguished from the closely related *H. scoparium* by its inflorescence which is densely covered with both simple villous and red glandular hairs and by its lanceolate outer sepals.

There is some evidence that limited hybridization has occurred between this species and at least one form of the bafflingly variable *H. scoparium*. Certain plants (Abrams & Wiggins 155 [UC] and Hoffman 15 June 1930 [SBM], which in most other respects would have been quickly relegated to the last mentioned species, proved exceptional

in possessing at least a moderate sprinkling of glandular trichomes very similar to those possessed by *H. Greenei*. At least three recognizable variants of *H. scoparium* are to be found within the confined range of *H. Greenei*. These are the so-called varieties *scoparium*, *vulgare*, and a comparatively rare form, possessing extremely mealy-pubescent stems and foliage, which has never been formally named and which occurs apparently only on Santa Cruz Island and the adjacent mainland of Santa Barbara and Ventura Counties. A few of the insular specimens of this unnamed variant possess some glandular trichomes of the sort found in *H. Greenei* which apparently grows in close proximity. Extensive field work within the Californian complex would doubtless prove most profitable.

Grosser (Pflanzenreich 14 IV. 193: 33. 1903.) assigned this species, *H. scoparium*, and the endemic Chilean *H. spartioides* to the section *Spartioides* of the segregate genus *Halimium*. Those three species were distinguished by him from other New World species of *Helianthemum* by their spartioid habit and isomorphic (chasmogamous) flowers. The floral characteristic for such separation has lost some of its value inasmuch as *H. nutans* and *H. patens* also have only isomorphic (chasmogamous) flowers and yet they are non-spartioid. This interesting disjunction pattern has recently been the subject of a stimulating symposium (Quart. Rev. Biol. 38: 109-177. 1963.)

REPRESENTATIVE SPECIMENS: CALIFORNIA: Los Angeles Co., Santa Catalina Island, ne. side of Black Jack Mt., *Blakley 5433* (SBBG); Santa Barbara Co., Santa Cruz Island, July & August 1886 *Greene* (ND, NY), April 1888 *Brandeggee* (GH, UC), *Abrams & Wiggins 156* (F, UC), *Clokey 5007* (GH, UC); Santa Barbara Co., Santa Rosa Island, *Epling & Erickson 8 Aug. 1937* (LA).

10. *Helianthemum scoparium* Nutt.

Helianthemum scoparium Nutt. in Torrey & Gray, Fl. N. Am. 1: 152. 1838. Type: *Nuttall*, not seen. "Dry hills around Monterey, California."

Linum trisepalum Kellogg, Proc. Calif. Acad. Sci. 3: 42. 1863. Type: not seen. *Bolander*, "on the White Hills back of Oakland."

Helianthemum Aldersonii Greene, Erythea 1: 259. 1893. Lectotype:

Alderson, June 1893. (JEPS!) "Mountains of the southern borders of San Diego Co., Calif."

Halimium scoparium (Nutt.) Gross., *Pflanzenreich* 14 (IV. 193) :35. 1903.

Helianthemum mendocinensis Eastwood ex Gross., *Pflanzenreich* 14 (IV. 193) : 35. 1903. nom. illegit. Art. 34(4); mistakenly published in synonymy of *Halimium occidentale* (Greene) Gross., a synonym of *H. Greenei* Robins.

Halimium Aldersonii (Greene) Standl., *Contr. U.S. Nat. Herb.* 23 (3) : 832. 1923.

Crocanthemum scoparium (Nutt.) Millsp., *Field Mus. Publ. Bot.* 5: 175. 1923.

Helianthemum scoparium var. *vulgare* Jepson, *Man. Fl. Pl. Calif.* 641. 1925. Lectotype: *Jepson* July 3, 1896, Coulterville [Mariposa Co., California]. (JEPS!)

Crocanthemum Aldersonii (Greene) Janchen, *Nat. Pflanzenfam.* ed. 2. 21: 305. 1925.

Helianthemum scoparium var. *Aldersonii* (Greene) Munz, *Man. South. Calif.* 316. 1935.

Helianthemum suffrutescens Schreiber, *Madroño* 5: 81. 1939. Type: *Schreiber 2243* (UC!). Isotype: (GH!). Amador Co.: dry slope 5.5 miles west southwest of Bisbee Peak, elevation 500 feet.

Suffruticose perennial, usually spartioid, (5)12-42(65) cm. tall with many stems arising from a woody caudex. STEMS spreading to erect, usually green and sparsely stellate-pubescent to glabrate (rarely covered with a dense stellate tomentum). LEAVES sessile or on petioles up to 3 mm. long; blade (4)7-26(43) mm. long, (8)10-15(24)-times longer than wide, (0.5)0.8-2.0(6.0) mm. wide, sometimes elliptic but usually narrowly oblanceolate to linear, green and sparsely stellate-pubescent to glabrate on both surfaces (occasionally covered with dense stellate tomentum); midvein prominent and secondary veins obscure beneath; base of blade attenuate, apex obtuse to acute; margin entire, mostly revolute. FLOWER: isomorphic (chasmogamous), few to many, paniculate to racemose or sometimes even appearing solitary at the tip of the very short branch (of the current year's growth). Pedicels and calyces glabrous to moderately stellate-pubescent (or more rarely covered with a dense stellate tomentum).

CHASMOGAMOUS FLOWERS: pedicels 2-12 mm. long, ranging from shorter to three-times longer than the length of the calyx. OUTER SEPALS (free portion) 0.5-4.5 mm. long, 0.1-0.8 the length of the inner sepals, 0.2-0.4 mm. wide, linear; INNER SEPALS 2.5-7.0 mm. long, 2.0-3.5 mm. wide, ovate, acuminate. PETALS 3-11 mm. long, 3-8 mm. wide, obovate, yellow. STAMENS 12-47. PISTIL 1.4-2.0 mm. long; ovary 0.8-1.2 mm. long, ovoid, glabrous; style 0.5-0.8 mm. long, sometimes nearly as long as the ovary; stigma 0.3-0.5 mm. wide. FRUITING

CALYX 3-8 mm. long, 2-3 mm. in diameter, ovoid. CAPSULE 2.5-4.0 mm. long, 1.8-2.7 mm. in diameter, ovoid, glabrous, 3-valved, each 1.8-2.7 mm. wide, ovate, acute. SEEDS 4-10, inequilateral, when moistened the thin membrane separable and with white papillae and the embryo visible.

FLOWERING: March-July. HABITAT: dry sandy or rocky soil of hills and ridges. DISTRIBUTION: along the Californian coast from Mendocino Co. southward into northwestern Baja California and along the Sierra Nevada mountains from El Dorado Co. southward into Fresno Co.; also known from several off-shore islands (Santa Rosa, Santa Cruz and Santa Catalina). (Map 11.)

Helianthemum scoparium is an unusually variable species, which may be deduced in part from the fact that since it was first described, two proposed species and several varieties have been segregated from it. In addition, several collections were designated as new entities in herbaria but apparently never published. Even this indicated diversity fails to express the observed variation.

The variation is particularly pronounced in respect to the habit, pubescence, number of flowers per inflorescence, size of inflorescence, length of both inner and outer sepals and the petals, and in the size as well as shape of the leaves. All of these variable characters have been used as criteria in specific or varietal segregation. Considerable time has been spent by us in examining more than 750 herbarium specimens in an attempt to determine what importance should be assigned to these characters, as well as to feasibility of specific and/or varietal segregation.

The plants collected along the immediate coast from Mendocino Co. southward into Santa Barbara Co. have a low, spreading to ascending habit, with but few comparatively large flowers either solitary at the tip of the very short branchlets to few in leafy racemose cymes. Their outer sepals are mostly 3-5 mm. long. The type of the species was based upon such plants.

Plants of the so-called var. *vulgare* are relatively taller than those mentioned above and are mostly ascending to erect, with more numerous but smaller flowers and with

outer sepals less than half as long as the inner ones. Such plants occur almost throughout the entire range of the species but are especially abundant along Coastal Ranges from Lake County south into northern Baja California.

The third previously recognized variant is a typically tall plant with an open panicle and with relatively longer petals. Plants possessing these features range from western San Bernardino Co. south into northern Baja California. Greene (*Erythea* 1: 259. 1893.) described such plants from the "mountains of the southern border of San Diego Co." as *H. Aldersonii*. Robinson (in Gray's *Syn. Fl. N. Am.* 1(1): 191. 1895.) treated Greene's *H. Aldersonii* as a synonym of *H. scoparium* stating "If Prof. Greene's species is represented as appears from character by Dr. Palmer's No. 18 from the same region, it is with little doubt merely a southern and more leafy form of *H. scoparium*, at least such was Dr. Gray's view."

The features employed by Munz to characterize var. *Aldersonii* do not appear distinctive when a large series of specimens is examined. It is certain that numerous specimens occur with the open inflorescence of *Aldersonii* but with smaller petals which fall within the range of *vulgare*. Specimens with characteristics designated by Munz for var. *Aldersonii* are found along the coast as well as in the inland area attributed to it. In many respects numerous plants from the lower slopes of the Central Sierra are intermediate between var. *vulgare* and var. *Aldersonii* in possessing the smaller petals of the former and the more open inflorescence of the latter.

Schreiber (*Madroño* 5: 81. 1939.) described plants from the foothills of the Central Sierra calling the proposed taxon *H. suffrutescens*. Schreiber's type was from Amador County but plants with these features were seen from four nearby counties.

The suggested differentiating characters prove variable even among specimens designated by Schreiber as *H. suffrutescens*. In addition, a comparison of the leaves of *H. suffrutescens* and *H. Aldersonii* shows them to be often similar in

size and shape although the leaves of Schreiber's plants were more pubescent. The greater degree of pubescence alone does not appear worthy of formal recognition. Schreiber herself admitted that there are no floral or seed differences between her species and *H. scoparium* var. *vulgare*.

A key is presented below based largely upon that published by Schreiber supplemented by the more recent treatment by Munz summarizing the differences supposedly distinguishing these taxa.

1. Leaves narrowly linear, green, sparsely stellate-pubescent to glabrous, deciduous in summer.
2. Plants low and divaricate, matted, with ultimate twigs erect; flowers few; inflorescence usually very leafy; inner sepals 4-5 mm. long; petals 5-7 mm. long (coastal from Mendocino Co. to Santa Barbara Co.). *H. scoparium* var. *scoparium*.
2. Plants tall and rush-like; flowers numerous; inflorescence sparsely leafy; inner sepals 2-6 mm. long; petals 4-12 mm. long.
3. Panicle usually narrow; petals about 4-6 mm. long; inner sepals 2-3.5 mm. long (from Lake Co. south into northern Baja California and on the lower slopes the Sierra from Placer Co. to Mariposa Co., also found on both Santa Catalina and Santa Cruz Islands.) *H. scoparium* var. *vulgare*.
3. Panicle extremely open; petals 8-12 mm. long; inner sepals 5-6 mm. long (from southwestern San Bernardino Co. south into northern Baja California). .. *H. scoparium* var. *Aldersonii*.
1. Leaves linear-lanceolate or oblanceolate, densely stellate-pubescent; not deciduous in summer (foothills of the Sierra in Amador Co.). *H. suffrutescens*.

At the present state of our knowledge we do not feel that the variation noted within this complex can best be treated by the recognition of formal infraspecific categories. The present system as illustrated by the above key is in our opinion unsatisfactory. For example, the erect var. *vulgare* apparently contains populations that have small flowers (as is called for by the key) and other populations whose large flowers closely approximate those of var. *scoparium*. Perhaps as many as one-fifth of the specimens examined possess a combination of characters which would make it difficult to refer them to any of the so-called varieties or species. Such plants occur nearly throughout the range of the species but

are most abundant and perplexing in the foothills of the central Sierras, southern California and the offshore islands.

The present unsatisfactory treatment can best be resolved by extensive observation of populations in their natural habitats together with transplant studies. The progeny of a few plants collected in the wild and grown at the Rancho Santa Ana appear to be quite different from their seed parent. We have pointed out under *H. Greenei* the presence of an unpublished variant of this species which occurs on several of the Channel Islands and to a limited extent upon the adjacent mainland that is rendered conspicuous by its mealy pubescence. We can only conclude that the entire complex is most deserving of intensive field study and that the problem does not lend itself to solution by reference to the herbarium.

REPRESENTATIVE SPECIMENS: UNITED STATES; CALIFORNIA: Amador Co., Ione, *Hoover 2415* (UC); Calaveras Co., 2.5 mi. nw. of Harmon Peak, *Roseberry 209* (UC); Contra Costa Co., Mount Diablo, Ridge south of Uncle Sam Canyon (on Eagle Point Ridge), *Bowerman 1598* (UC); El Dorado Co., Sweetwater Creek, June 1907, *Simpson* (UC); Fresno Co.: Chaparral, at n. end of the sw. facing Big Sandy Bluffs, 2 June 1935, *Quibell* (COLO); Lake Co.: hills west of Mirabel Mine, *Mason 8324* (UC); Los Angeles Co.; dry ridges and hill sides, Mandeville Canyon, Santa Monica Mountains, *Clokey & Templeton 4490* (F, GA, GH, ILL, MIN, MO, NO, PENN, UC, US, WIS); Santa Cataline Island, *Nuttall 154* (UC); Marin Co., Mt. Tamalpais, *Heller 5721 a* (F, GH, MO, PH, US); Mariposa Co., Devil's Gulch, 4 July 1892, *Congdon* (MIN); Mendocino Co.: about Mendocino, *Brown 785* (F, MIN, MO, UC); Monterey Co., from type locality along the railroad near seaside (beyond Del Monte), *Heller 6751* (COLO, F, GH, IND, ISC, MIN, MO, UC, US, WIS); Napa Co., Sarco Creek 4 mi. above Napa, *Ewan 8825* (NO, SMU); Orange Co., Santa Ana River Canyon, *Munz & Johnston 5307* (UC); San Benito Co., 10 mi. below San Benito, *Fosberg S4992* (GH, KANU); San Bernardino Co., Etiwanda, *Abrams 2664* (DS, GH, MO, PH, UC, US); San Diego Co., La Jolla, *Clements & Clements 40* (ARIZ, COLO, F, GH, ILL, PENN, PH, MIN, MO, UC); San Francisco Co., without exact locality, *Michener & Bioletti* (GH); San Luis Obispo Co., 1.5 mi. sw. of Los Berros, *Lee 411* (UC); San Mateo Co., Pilarcitos Lake and Canyon, *Davy 1157* (UC); Santa Barbara Co., Santa Cruz Island, *Clokey 5006* (GH, ILL, MIN, PENN, UC, US); Carpinteria, 26 March 1958, *Pollard* (ARIZ, TEX); Santa Rosa Island, June 1888, *Brandeggee* (GH, UC); Santa Clara Co., foothills west of Los Gatos, *Heller 7350* (F, GH, ILL, IND, ISC, MO, PH, UC, US, WIS); Santa

Cruz Co., Pine Mt. Trail, Big Basin, *Mason 2247* (UC); Sonoma Co., Vine Hill, w. of Santa Rosa, *Heiser 1744* (UC); Ventura Co., near North Signal Street, 17 April 1945, *Pollard* (GH). MEXICO: BAJA CALIFORNIA: Burned over hills about 20 mi. e. of Ensenada, *Wiggins 11867* (DS, UC); Tecate, n. Baja California, *Fosberg 8346* (DS, MO, PENN).

11. *Helianthemum nutans* T. S. Brandeg.

Helianthemum nutans T. S. Brandeg., Proc. Calif. Acad. ser. 2. 2: 129.

1889. Type: *Brandeggee*, 7 May 1889 (UC!). Isotypes: (A, F, NY, US!). "very abundant in rocky soil about the plains of San Julian" Baja California.

Halimium nutans (T. S. Brandeg.) Standl., Contr. U.S. Herb. 23(3): 834. 1923.

Crocanthemum nutans (T. S. Brandeg.) Janchen, Nat. Pflanzenfam. ed. 2. 21: 207. 1925.

Bushy shrub, 10-30 cm. tall with few to numerous stems arising from a thick woody root. STEMS woody, gray, ascending, much branched. BRANCHES ascending, woody, with numerous, bushily arranged ultimate branchlets; those of the current growth light green and densely, short stellate-pubescent. LEAVES only on current season's growth, sessile; blade 5-8 mm. long, 0.8-1.5 mm. wide; spatulate-oblongate, broader above the middle; light green and very densely short stellate-pubescent on both surfaces and also ciliate with 1-3 simple hairs (1-1.5 mm. long) along both margins of the blade; mid-vein but slightly elevated and secondary veins obscure beneath; leaf-blade tapering to the base, apex obtuse to somewhat acute; margin entire, non-revolute. (The old branches covered with axillary fascicles of small leaves that persist long after the principal leaves have fallen). FLOWERS isomorphic (chasmogamous), few on each branchlet, borne in a sympodial inflorescence but appearing solitary, either alternating with or opposite the leaves. Pedicel and calyx stellate-puberulent, sometimes the calyx with few simple, elongate trichomes resembling those of the leaf margin.

CHASMOGAMOUS FLOWERS: pedicels 7-15 mm. long, somewhat curved, and articulate at the base. OUTER SEPALS (free portion) 2-4 mm. long, 1/3-1/2 the length of the inner sepals, 0.2-0.3 mm. wide, linear; INNER SEPALS 5.5-7.0 mm. long, 2.8-3.2 mm. wide, ovate-lanceolate, twice longer than wide, acute, bright green. COROLLA bright yellow; petals 7-9 mm. long, 5-7 mm. wide, broadly cuneate. STAMENS 25-32. PISTIL 1.6-2.0 mm. long; ovary 1.2-1.4 mm. long, 0.8-1.0 mm. in diameter, ovoid, glabrous; style 0.4-0.6 mm. long; stigma 0.4-0.6 mm. wide, capitate. FRUITING CALYX 6-8 mm. long, 3.0-3.5 mm. in diameter, narrowly ovoid. CAPSULE 4.8-5.2 mm. long, 2.4-2.7 mm. in diameter, narrowly ovoid-triangular, about twice as long as wide, glabrous, 3-valved, each valve 2.4-2.7 mm. wide, narrowly ovate, acute, slightly

concave. SEEDS 20-26, inequilateral, the thin seed membrane with numerous white papillae especially on the edges of the seed; the membrane separable when moistened and then the embryo becoming somewhat visible.

FLOWERING: February-April. HABITAT: on dry, rocky soil of flats and gullies. DISTRIBUTION: southern Baja California, Mexico. (Map 16, large dots.)

This little-collected species is endemic to Baja California. It can be easily distinguished from all other North American species of *Helianthemum* by its low, shrubby and much-branched habit, and by its spatulate leaves (0.5-1.5 mm. wide) whose margins bear on each side 1-3 simple hairs about 1.0-1.5 mm. long.

Grosser (Pflanzenreich 14 (IV. 193): 52. 1903.) supposed, judging only from the original description, that this species might be closely related to *H. scoparium*. The unique features possessed by this species would seem to indicate a relatively isolated position within the genus.

REPRESENTATIVE SPECIMENS: MEXICO: BAJA CALIFORNIA: Lower California, Plains of San Julian, 7 May 1889, *Brandeggee* (A, F, NY, UC, US); 5 mi. n. of Mesquital Grande, 9 Feb. 1935, *Haines & Stewart* (A, ARIZ, DS, F, ILL, ND, RSA, TEX, UC); bushy gully in Cretaceous Sediments, 4 mi. e. of Santa Catarina Landing, *Dressler* 610 (MO); locally common on bare flat area near Agua de Higuera, *Moran* 10232 (DUKE, SD).

12. *Helianthemum patens* Hemsl.

Helianthemum patens Hemsl., Diagn. Pl. Nov. Mex. et Centr. Amer. part 2: 20. 1879. Type: *Parry & Palmer* 30 (K). Isotypes: (F, GH, MO, NY, US!). "Mexico: in regione San Luis Potosi, alt. 6000-8000 ped."

Halimium patens (Hemsl.) Gross., Pflanzenreich 14 (IV. 193): 46. 1903.

Perennial herb or somewhat suffruticose, (3)10-17(30) cm. tall with one to few stems arising from a woody caudex. STEMS ascending to erect, glabrous or densely stellate-pubescent, branching from near the base. LEAVES (on current season's growth) sessile or on petioles up to 1.0 mm. long; blade 2-8(15) mm. long, 0.6-4.0(6.0) mm. wide, ovate-elliptic or lanceolate, glabrous or sparsely to densely stellate-pubescent on both sides, midvein prominent and secondary veins obscure beneath; base of blade cuneate, apex acute or pointed and lustrous; margin entire or nearly so, non-revolute. Glabrous leaf-blades generally

lanceolate and 5-times or more longer than wide; the sparsely to densely stellate-pubescent leaf-blades generally ovate-elliptic and 5-times longer than wide or less. FLOWERS isomorphic (chasmogamous) and with but few on each branch, borne in sympodial inflorescences but appearing solitary, axillary, or subterminal and either alternating or opposite the leaves.

CHASMOGAMOUS FLOWERS: pedicels 5-15 mm. long, (1)1.5-3 times longer than calyx, divergent to ascending, purple or greenish or even hoary in color, glabrous or stellate-pubescent, disarticulating near the base. CALYX either glabrous and lustrous and mostly purplish, or sparsely stellate-pubescent intermixed with simple villous hairs or densely and minutely stellate-pubescent. OUTER SEPALS (free portion) 1.0-2.4 mm. long, $\frac{1}{4}$ - $\frac{1}{2}$ the length of the inner sepals, 0.2-0.4 mm. wide, linear; INNER SEPALS 2.6-4.0 mm. long, 1.6-2.5 mm. wide, ovate, acute. COROLLA pale yellow; petals 3-6 mm. long, 2.4-5.0 mm. wide, obovate. STAMENS 10-14(20). PISTIL 1.4-1.7 mm. long; ovary 0.8-1.2 mm. long, c. 0.8 mm. in diameter, ovoid, glabrous; style 0.2-0.5 mm. long; stigma 0.3-0.6 mm. wide, capitate. FRUITING CALYX 3-5 mm. long, 2.5-4.0 mm. in diameter, ovoid to subglobose. CAPSULE 3-4 mm. long, 2.4-3.2 mm. in diameter, ovoid to subglobose, 3-valved; each valve 2.4-3.2 mm. wide, ovate, acute, somewhat rounded at the back. SEEDS 10-13(20), inequilateral, light brown, with separable membrane when moistened and the embryo then visible.

FLOWERING: May-August. HABITAT: dry open rocky, grassland hills and old lava among oak scrub. DISTRIBUTION: Mexico: from Zacatecas and San Luis Potosí to southeastern Puebla. (Map 16, small dots.)

Helianthemum patens can be readily distinguished from all central Mexican species by its relatively few petaliferous flowers borne on divergent to ascendent pedicels 1-3 times longer than its calyces in a sympodial, axillary or subterminal inflorescence.

Helianthemum nutans of Baja California has the same kind of inflorescence but is easily distinguished from *H. patens* by its shrubby and much-branched habit, by its fasciculate leaves that persist long after the principal leaves have fallen, and by the few simple hairs (1.0-1.5 mm. long) on the margin of the leaf.

Grosser (Pflanzenreich 14 (IV. 193) : 47. 1903.) treated this species as having dimorphic flowers, but no cleistogamous flowers were seen by us on any of the specimens

examined. *Helianthemum patens* together with *H. nutans*, *H. scoparium*, and *H. Greenei* are the only North American species having only petaliferous flowers.

Vegetatively this is a rather variable species. Specimens examined may be arranged into three pubescence types. Plants collected from near the center of distribution of the species are light green, glabrous and lustrous throughout and have lanceolate leaves. Plants collected from the middle and southern portion of the species distribution are green, sparsely stellate-pubescent, somewhat lustrous and with ovate-elliptic leaves. The isotypes (and hence presumably the type) and the majority of the specimens examined belong to this form. Plants collected from the central and northern range of the species distributed are green or sometimes hoary, densely stellate-pubescent throughout, with ovate-elliptic leaves, and more woody than the other two. Specimens of all three types have however been collected in the same locality. More collections are necessary before any attempt to evaluate these conspicuous variants would appear warranted.

All North American species of *Helianthemum* are stellate-pubescent except for the few specimens of this species which were completely glabrous.

REPRESENTATIVE SPECIMENS: MEXICO: JALISCO: sw. of Ojuelos on road to Aguascalientes, *McVaugh* 16799 (MICH), *McVaugh* 16849 (MICH), *McVaugh* 16850 (MICH); *McVaugh* 16851 (MICH). PUEBLA: vicinity of San Luis Tultitanapa, near Oaxaca, *Purpus* 3383 (F, GH, MO, UC); below Atzizintla (San Antonio), *Balls* 5315 (A, UC); Esperanza, *Purpus* 2486 (F, GH, MO, UC); Esperanza, *Balls* 5401 (GH, UC); SAN LUIS POTOSI: San Rafael, *Schaffner* 498 (F, ISC, MICH, MIN, PH, POM); chiefly in the region of San Luis Potosí, *Parry & Palmer* 28½ (GH, PH), *Parry & Palmer* 30 (F, GH, MO, NY, US); Mts. w. of San Luis Potosí, Sierra Madre Oriental, *Pennell* 17630 (MICH, NY, PH, UC); Alvarez, *Palmer* 602 (F, GH); ZACATECAS: 25 mi. nw. of Fresnillo, *Waterfall* 15590 & 15591 (OKLA); Zacatecas, Aug. 1903, *Purpus* (UC).

13. *Helianthemum corymbosum* Michx.

Helianthemum corymbosum Michx., Fl. Bor.-Am. 1: 307. 1803. Type: Michaux (P). Photograph of type (GH!). "In maritimis Carolinae et Georgiae."

Cistus corymbosus (Michx.) Poir., Encyc. Suppl. 2: 272. 1811.

Heteromeris cymosa Spach, Ann. Sci. Nat. 2nd. ser. 6: 370. 1836. nom. nud. & illegit. since *Helianthemum corymbosum* Michx. is cited as a synonym; descr. Spach, Hist. Nat. Vég. Phanér. 6: 103. 1838, but *Helianthemum corymbosum* Michx. is again cited as a synonym.

Halimium corymbosum (Michx.) Gross., Pflanzenreich 14 (IV. 193): 49. 1903.

Crocanthemum corymbosum (Michx.) Britt. in Britton & Brown, Ill. Fl. ed. 2. 2: 541. 1913.

Perennial herb or rarely suffruticose, (7)11-30(52) cm. tall with one to many stems arising from a caudex. STEMS erect or nearly so, covered with appressed stellate-pubescence but becoming glabrate. BRANCHES alternate, wiry, ascending, mostly restricted to the upper half of the stem. CAULINE LEAVES: petiole 1-5 mm. long; blades (9)18-35(47) mm. long, (1.5)4-10(13) mm. wide; obovate-elliptic, elliptic to elliptic-lanceolate near the apex, green and stellate-puberulent beneath, conspicuously discolorous; midvein and secondary veins prominent beneath; base of blade cuneate, apex obtuse or nearly so to acute; margin entire, upper leaves slightly revolute. INFLORESCENCE: a compound dichasium terminating the stem and sometimes the branches. FLOWERS dimorphic; the long-pedicellate chasmogamous flowers overtopping the very shortly pedicellate, smaller, more numerous and congested cleistogamous flowers. Bracts 1.6-7 mm. long, 0.2-1.2 mm. wide, spatulate-linear. Pedicel and calyx covered with short stellate pubescence and also with longer (0.5-1.5 mm. long), simple, often very abundant, villous trichomes.

CHASMOGAMOUS FLOWERS: pedicels 6-15(28) mm. long, 1-5 times longer than calyx. OUTER SEPALS (free portion) 2.4-4(5.2) mm. long, 0.7-1.2 mm. wide, spatulate-linear, apex obtuse or nearly so, often drying brownish; INNER SEPALS 3-6(8) mm. long, 2.5-3.6 mm. wide, ovate, acute to acuminate. PETALS 6-11 mm. long, 5-9.5 mm. wide, obovate. STAMENS 20-30. PISTIL 1-1.4 mm. long, ovary 0.7-1.1 mm. long, 0.6-1 mm. wide, ovoid, glabrous; style 0.2-0.5 mm. long; stigma 0.5-1 mm. wide, capitate. FRUITING CALYX 4-6.5(7.8) mm. long, 1.5-5 mm. in diameter. CAPSULE 3.6-5.4 mm. long, 3-4 mm. in diameter, ovoid and somewhat angled, apiculate, glabrous, 3-valved; each valve 2.4-3.3 mm. wide, ovate, acute, slightly concave; funiculi and placentae remaining attached to the receptacle after valves and seeds have fallen. SEEDS 15-30, ovoid to somewhat irregular, light to dark brown, smooth and with a thin, separable membrane.

CLEISTOGAMOUS FLOWERS: numerous, subsessile, sepal tips (especially the outer ones) brown. STAMENS 4-6. FRUITING PEDICELS 1-2.5 mm. long, shorter than calyx. FRUITING CALYX 2.2-4.8 mm. long, 1.8-3.5 mm. in diameter, ovoid. OUTER SEPALS (free portion) 1.8-3 mm. long, 0.3-0.9 mm. wide, spatulate-linear, apex obtuse or nearly so and brown; INNER SEPALS 2.2-4.8 mm. long, 1.2-3 mm. wide, ovate, acute. CAPSULE 1.6-3.8

mm. long, 1.4-3 mm. in diameter, ovoid-triquetrous, apiculate, 3-valved; each valve 1.4-2.4 mm. wide, ovate-elliptic, acute, slightly concave; funiculi and placentae remaining attached to the receptacle after valves and seeds have fallen. SEEDS 4-8(10), similar to those in the chasmogamous fruit.

FLOWERING: February-April. HABITAT: sand dunes and beaches, dry sandy pinelands, fields and openings in live-oak woodlands. DISTRIBUTION: along the Coastal Plain of North Carolina southward throughout peninsular Florida and west along the Gulf Coast into Mississippi. (Map 8.)

REPRESENTATIVE SPECIMENS: NORTH CAROLINA: Carteret Co., Lennox Point, Beaufort, *Godfrey 49843* (COLO, DS, DUKE, FSU, ILL, IA, IND, ISC, KANU, MIN, NCSC, NCU, NY, PENN, PH, SMU, TEX, UC, US, WIS, WVA); Dare Co., pineland at Frisco, *Radford, Haesloop & Miller 7790* (NCU). SOUTH CAROLINA: Beaufort Co., Hunting Island State Park, *Bell 2478* (FSU, NCU); Berkeley Co., 5 mi. w. of Pineville, *Godfrey & Tryon 1134* (GH, NY, US); Charleston Co., Isle of Palms, *Robinson 133* (GH); Georgetown Co., 3 mi. e. of Georgetown, *Godfrey & Tryon 1085* (CU, DUKE, GH, MICH, MO, MIN, NY, PENN, TENN, PH, UC, US). GEORGIA: Charlton Co., at Camp Cornelia, *Duncan 7428* (GA, NCSC, SMU); Chatham Co., Tybee Island, *Harper 2173* (GH, MO, NY, US). FLORIDA: Broward Co., Hollywood, *Moldenke 599* (DUKE, ILL, MO, NY, PENN); Citrus Co., s. of Inverness, *Cooley, Wood & Wilson 5936* (NCU, US, USF); Clay Co., Hibernia, March 1869, *Canby* (F, GH, MO, MICH, NY, US); Dade Co., Humbugus Prairie, *Small & Mosier 5602* (DUKE, FLAS, GH, NCU, NY, US); Dixie Co., 10 mi. n. of Suwannee, *Godfrey 56476* (DUKE, FSU, IA, USF, UC, VDB); Duval Co., near Jacksonville, *Curtiss 4601* (GH, ISC, MIN, MSC, NY, UC, US); *Curtiss 227* (CU, F, FLAS, GH, IA, KANU, MIN, MO, NY, PH, SMU, UC, US); Franklin Co., Alligator Point, *Godfrey 53201* (DUKE, FSU, GH, IA, NCSC, NCU, NY, USF, VDB); Lake Co., vicinity of Eustis, *Nash 137* (GH, MIN, MSC, NY, PH, UC, US); Lee Co., w. of Fort Myers, *Moldenke 926* (DUKE, ILL, MIN, MO, NY, PENN). MISSISSIPPI: Harrison Co., Cat Island, *Ray 2728* (USF).

14. *Helianthemum concolor* (Riley) Ortega

Halimium concolor Riley, Kew Bull. 1923: 107. 19 April 1923. Type: *Gonzalez 842* (K) not seen. "San Ignaciei Cerro del Buen Retiro, 1660 M." Sinaloa.

Halimium exaltatum Rose & Standl., Contr. U.S. Nat. Herb. 23 (3): 833. 18 July 1923; *ibid.*, 23: 1675. 1926, Riley's epithet cited as follows: "Page 833. *Halimium exaltatum*. A synonym is *Halimium discolor* [sic] Riley, Kew Bull. 1923: 107. 1923." Type: *Pringle 10409* (US!). Isotypes: (F, DUKE, GH, OKLA, MIN, MSC, SMU!). "dry hills above Uruapan, Michoacan, alt. 1,500 m."

Crocanthemum exaltatum (Rose & Standl.) Janchen, Nat. Pflanzenfam. ed. 2. 21: 305. 1925.

Helianthemum concolor (Riley) Ortega, Cat. Sist. Pl. Sinaloa 4. 1929.
Helianthemum exaltatum (Rose & Standl.) Ortega, Cat. Sist. Pl. Sinaloa 4. 1929.

Shrub up to 1 m. tall. STEMS erect, coarsely stellate-pubescent. CAULINE LEAVES: petiole 3-5 mm. long; blade 11-42 mm. long, 5-20 mm. wide; elliptic-obovate, green and sparsely stellate-pubescent on both sides, lower epidermis conspicuous and not masked by the pubescence; midvein and secondary veins conspicuous and mostly elevated beneath; base of blade attenuate, apex obtuse to acute, sometimes mucronate; margin entire, non-revolute. FLOWERS dimorphic (chasmogamous and cleistogamous) crowded at the end of the stem and branches. Chasmogamous flowers fewer and on pedicels subequaling to slightly longer than those of the cleistogamous flowers. Pedicel and calyx covered with short stellate-pubescence and with white and with much longer, coarse, stellate-pubescence, with the individual trichomes up to 2 mm. long. Bracts numerous, 2-6 mm. long, 0.2-0.5 mm. wide, linear to narrowly lanceolate.

CHASMOGAMOUS FLOWERS: pedicels 3.5-9.5 mm. long. OUTER SEPALS (free portion) 2.5-5.0 mm. long, 0.2-0.3 mm. wide, very narrowly linear; INNER SEPALS 4.5-7.0 mm. long, 2.8-3.6 mm. wide, ovate, acuminate, sometimes with veins prominent at the back. COROLLA yellow, petals 5-8 mm. long, 5-6 mm. wide, obovate. STAMENS 20-30. PISTIL 1.6-2.0 mm. long; ovary 1.2-1.6 mm. long, 0.5-0.8 mm. in diameter, ovoid, glabrous; style 0.4-0.7 mm. long; stigma 0.3-0.4 mm. wide, capitate. Chasmogamous flowers with mature fruit not seen.

CLEISTOGAMOUS FLOWERS: pedicels 2-3 (up to 5 at fruiting) mm. long. Outer sepals (free portion) 2.0-3.6 mm. long, 0.1-0.3 mm. wide, narrowly linear; INNER SEPALS 3.5-5.0 mm. long, 1.6-2.0 mm. wide, ovate-lanceolate, acuminate. STAMENS 5-7. PISTIL 1.5-2.0 mm. long, ovary ovoid, glabrous. FRUITING CALYX 4.8-6.5 mm. long, 2.4-3.6 mm. in diameter, ovoid. CAPSULE 3.6-4.4 mm. long, about twice longer than wide, 1.7-2.5 mm. in diameter, ovoid-triquetrous, glabrous, 3-valved; each valve 1.7-2.4 mm. wide, ovate to ovate-lanceolate, acute. SEEDS 4-7, ovoid or depressed on both sides, with thin separable membrane and the embryo becoming visible when seed is moistened.

FLOWERING: October-February. HABITAT: Dry hillsides. DISTRIBUTION: Mexico: southern Sinaloa, northwestern Jalisco, central and northwestern Michoacán, and southwestern Mexico State. (Map 17, small dots).

This is the only Mexican species with a leaf-blade so sparsely stellate-pubescent that the epidermis is readily visible beneath.

SPECIMENS EXAMINED: MEXICO: JALISCO: San Sebastián, Segundo Arroyo, *Mexia* 1542 (UC); trail from Real Alto to San Sabestián, *Mexia* 1773 (F, UC). MEXICO: Dist. Temascaltepec, Pineda,

Hinton 3190 (ARIZ, GH, PH). MICHOACÁN: Uruapan, *Pringle 13447* (GH, MICH); dry hills above Uruapan, *Pringle 10409* (F, DUKE, GH, OKLA, MIN, MSC, SMU, US); Dist. Coalcomán, Coalcomán, *Hinton 12960* (ARIZ, GH). SINALOA: 3.7 mi. e. of Portrerillos; ca. 36 mi. e. of Concordia, *Breedlove 1679* (DUKE).

15. *Helianthemum georgianum* Chapm.

Helianthemum georgianum Chapm., Fl. S. U.S. ed. 3. 36. 1897.

"Bainbridge, Georgia, Mobile (Mohr)." Lectotype: *Chapman* (MO!).

Halimium georgianum (Chapm.) Gross., Pflanzenreich 14 (IV. 193): 49. 1903.

Crocanthemum stipulatum Janchen, Öster. Bot. Zeit. 71: 269. 1922.

Type: *Tracy 8060*. (W, not seen.) Isotypes: (all seen F, GH, MIN, OS, TEX, UC). Weatherford, Texas.

Crocanthemum georgianum (Chapm.) Barnh. in Small, Man. SE. U.S. Fl. 879. 1933.

Perennial herb or very rarely suffruticose, (10)15-30(40) cm. tall with few to many stems arising from a caudex, spreading by slender, shallowly placed, horizontal roots. STEMS ascending to erect, stellate-tomentose, divergently branched. BASAL LEAVES often in a rosette or forming a mat at the base of the stem, but frequently lacking; petiole 1-2 mm. long; blade 10-28 mm. long, 4.5-11.0 mm. wide; spatulate-oblongate, stellate-tomentose on both surfaces; base of blade attenuate, apex obtuse to acute; margin entire, non-revolute. CAULINE LEAVES: estipulate (sometimes with smaller axillary fasciculate leaves at first resembling stipules); petiole 1-3 mm. long; blade (7)20-35(44) mm. long, (1.2)4.5-8.5(12) mm. wide; oblanceolate and becoming narrowly elliptic near the top of the stem, green and stellate-pubescent above, hoary and stellate-tomentose beneath; midvein and secondary veins prominent beneath; base of blade attenuate to cuneate, apex obtuse to acute; margin entire, the upper leaves somewhat revolute. FLOWERS dimorphic (chasmogamous and cleistogamous), 2-7 in racemose cyme at the end of the main stem and lateral branches. First chasmogamous flowers borne on longer pedicels. Bracts 1.2-5.0 mm. long, 0.3-1.0 mm. wide, lanceolate. Pedicel and calyx stellate-canescant.

CHASMOGAMOUS FLOWERS: pedicels 5-12(15) mm. long, 1-3 times longer than calyx. OUTER SEPALS (free portion) 1.5-3.5 mm. long, 5-10 times longer than wide, 0.3-0.5 mm. wide, linear; INNER SEPALS 3.6-6.6 mm. long, 3.0-4.5 mm. wide, ovate, acute. PETALS 6-10(12) mm. long, 4-8(11) mm. wide, obovate. STAMENS (15)20-36. PISTIL 1.2-2.5 mm. long; ovary 0.8-1.7 mm. long, 0.8-1.2 mm. in diameter, ovoid, glabrous; style 0.3-0.7 mm. long; stigma 0.6-1.0 mm. wide, capitate. FRUITING PEDICELS 6-13(16) mm. long. FRUITING CALYX 5.0-7.2 mm. long, 4.2-5.4 mm. in diameter, ovoid. CAPSULE 3.8-5.7 mm. long, 3.2-4.5 mm. in diameter, ovoid, apiculate, glabrous, 3-valved; each valve 3.0-4.2 mm. wide, ovate, acute, slightly concave. SEEDS 20-35, ovoid-depressed to

inequilateral, smooth and when moistened, the membrane separable and the embryo visible.

CLEISTOGAMOUS FLOWERS: pedicels 0.6-3.0 mm. long. OUTER SEPALS (free portion) 1.4-2.2 mm. long, c. 0.3 mm. wide, linear; INNER SEPALS 3.0-4.2 mm. long, 2.6-3.8 mm. wide, ovate, acute. STAMENS (3)5(8), remaining attached to the base of the capsule. PISTIL 1.3-1.7 mm. long, ovary ovoid, glabrous. FRUITING PEDICELS 2-6 mm. long. FRUITING CALYX 4.0-5.4 mm. long, 3.2-4.8 mm. in diameter, ovoid. OUTER SEPALS (free portion) 1.9-3.0 mm. long, 5-10 times longer than wide, 0.3-0.5 mm. wide, linear; INNER SEPALS 4.0-5.4 mm. long, 3-4 mm. wide, ovate, acute. CAPSULE 3.0-4.2 mm. long, 2.4-3.3 mm. in diameter, ovoid, glabrous, with 3 valves; each valve 1.9-3.0 mm. wide, ovate, acute. SEEDS 12-20, similar to the seeds of the chasmogamous flowers.

FLOWERING: April-June. HABITAT: Dry, open, sandy woods and fields, turkey oak sand-ridges, and sand-dunes along the beach. DISTRIBUTION: along the coast from North Carolina to northern Florida, westward along the Gulf Coast to Louisiana, and through most of eastern and central Texas; also known from southern Oklahoma and southern Arkansas. (Map 2.)

The 2-7 dimorphic flowers in racemose cymes at the end of the principal branches, and the frequent presence of basal leaves are enough to distinguish this species from any other *Helianthemum* in the United States or Canada. The inflorescence of *H. georgianum* is approached by that of the Mexican and Central American *H. Pringlei*. However, the leaves of *H. georgianum* are long-petiolate and with prominent secondary veins beneath in contrast to the sessile or short-petiolate leaves with obscure secondary veins of *H. Pringlei*. In addition basal leaves are often present in *H. georgianum* while they are always lacking in *H. Pringlei*.

It was at first felt that an undescribed taxon rested undetected under the binomial of this species. Specimens obtained from the sandy maritime forests from the Carolinas and from the offshore islands in the Gulf of Mexico have a very different appearance from the majority of the specimens which resemble those collected in the eastern half of Texas. We were unable to find characters however to substantiate the different appearance that this extreme presents. They were noticeably different from the norm in

their generally low habit and but few (2(3)), mostly cleistogamous flowers.

Janchen (Öster. Bot. Zeit. 71: 269. 1922.) redescribed this species as *Crocanthemum stipulatum*, although all of the New World species of *Helianthemum* are estipulate. Janchen considered the small, fasciculate leaves found in the axil of the cauline leaves to be stipules and felt that this difference alone was of such importance that he had no hesitation to describe the new species on the basis of only this distinction.

REPRESENTATIVE SPECIMENS: NORTH CAROLINA: Brunswick Co., Southport, *Correll & Bloomquist 440* (PENN); Carteret Co., Lennox Point, e. of Beaufort, *Fox & Godfrey 2694* (GH, NCSC, NY, PH); Dare Co.: maritime forest at Buxton, *Radford, Haesloop & Miller 7580* (NCU). SOUTH CAROLINA: Horry Co.: Myrtle Beach, *Wilbur 6974* (DUKE). GEORGIA: Decatur Co., Bainbridge, *Chapman* (IA, MO); Dougherty Co., Albany, 21 May 1930, *Harper* (ARIZ, F, GH, MICH, MO, NY, PH, US); McIntosh Co., in southeast section of Sapelo Island, *Adams & Duncan 17887* (NCSC). FLORIDA: Gadsden Co., near River Junction, *Curtiss 6392* (DS, F, GH, ILL, ISC, MIN, MO, NY, SMU, UC, US); Okaloosa Co., 0.5 mi. w. of Mary Esther, *Godfrey 56671* (FSU, IA, MSC, NY, UC, USF); Wakulla Co., along the beach, Mashes Island, *Godfrey 53203* (DUKE, FSU, GH, IA, NCSC, NCU, NY, TENN, USF, VDB); Walton Co., 5 mi. w. of Portland, *Godfrey 56662* (FSU, IA, UC, VDB). ALABAMA: Mobile Co., Spring Hill, *Mackenzie 4032* (GH, IND, MIN, NY). MISSISSIPPI: Harrison Co., Deer Island, *Pollard 1184* (CU, F, GH, MO, NY, OS, US). LOUISIANA: Natchitoches Parish, Chopin, *Palmer 7985* (NY, US). ARKANSAS: Ouachita Co., near Chidester, *Moore 56-138* (NY). OKLAHOMA: Marshall Co., Lake Texoma, 20 June 1960, *Penfound* (OKL). TEXAS: Bastrop Co., West Point, *Barkley et al 7039* (BUS, COLO, DUKE, FLAS, GH, ILL, ISC, MIN, PENN, TEX); Denton Co., near Roanoke, *Lundell & Lundell 9539* (DS, GH, MICH, SMU); Llano Co., Enchanted Rock, *Tharp et al 47273* (BUS, COLO, DUKE, FLAS, GH, ISC, MIN, TEX); Mason Co., 7 mi. n. of Mason, *McVaugh 8318* (F, GH, MICH, SMU, TEX); Parker Co., Weatherford, *Tracy 8060* (F, GH, MIN, MSC, OS, TEX, UC); Taylor Co., 1 mi. n. of Abilene, *Tolstead 7499* (MO, NCSC, NY, SMU, TEX, UC); Travis Co., Austin, *Tharp 44105* (COLO, DS, DUKE, FSU, IA, ILL, IND, ISC, MO, NCU, NO, NY, OKL, OKLA, PH, SMU, UARK, UC, VDB, WVA).

16. *Helianthemum Pringlei* S. Wats.

Helianthemum Pringlei S. Wats., Proc. Am. Acad. 23: 268. 1888.

Type: *Pringle 1186*, September 1887 (GH!). Isotypes: (F, MIN, MSC, NY, UC, US!). "On pine plains at the base of the Sierra Madre, Chihuahua."

Halimium Pringlei (S. Wats.) Gross., Pflanzenreich 14 (IV. 193): 46. 1903.

Heteromeris Pringlei (S. Wats.) Ponzo, Nuovo Gior. Bot. Ital. n. s. 28: 169. 1921. (No basionym cited).

Crocanthemum Pringlei (S. Wats.) Janchen, Nat. Pflanzenfam. ed. 2. 21: 305. 1925.

Perennial herb or sometimes suffruticose, 10-42 cm. tall, with few stems arising from an upright caudex (or rarely from a horizontal, subterranean rootstock). STEMS branched, erect to ascending, stellate-pubescent, but also sometimes intermixed with simple, villous hairs on the lower half. CAULINE LEAVES: mostly appressed to the stem, sometimes with but few and small fasciculate leaves in their axils; sessile or with petiole up to 1 mm. long; blade 4.5-25 mm. long, 2.0-5(7.0) mm. wide, elliptic or oblance-elliptic, rarely the lowermost obovate, grayish and stellate-tomentose on both surfaces, or occasionally intermixed with simple villous hairs (especially those on the lower half of the stem); midrib conspicuous and elevated beneath, secondary veins obscure; base of blade cuneate, the apex subacute to acute; margin entire, nonrevolute. FLOWERS: dimorphic (chasmogamous and cleistogamous), 2-5 in racemose cymes terminating the stem and the branches. Pedicel and calyx stellate-tomentose (the outer sepals very rarely villous). Bracts 2-7 mm. long, 0.5-1.5 mm. wide, linear-lanceolate or narrowly elliptic.

CHASMOGAMOUS FLOWERS: pedicels 2-12 mm. long, shorter than to twice longer than calyx, articulate, sometimes purplish. OUTER SEPALS (free portion) 1.2-3.2 mm. long, 0.2-0.4 mm. wide, linear; INNER SEPALS 4-6 mm. long, 2-3 mm. wide, ovate, acute, sometimes purplish. PETALS 5-10 mm. long, 3.6-8.5 mm. wide, yellow or sometimes with purple spot at the middle of the upper edge. STAMENS 25-36. PISTIL 1.4-2.0 mm. long; ovary 1.0-1.4 mm. long, 0.8-1.0 mm. in diameter, ovoid, glabrous; style 0.4-0.6 mm. long; stigma 0.6-0.8 mm. wide, capitate. FRUITING PEDICELS 3-12 mm. long, shorter to twice longer than calyx, articulate. FRUITING CALYX 4.0-6.5 mm. long, 4-5 mm. in diameter, ovoid, sometimes with a distinct base. OUTER SEPALS (free portion) 2.2-3.2 mm. long, 0.2-0.4 mm. wide, linear; INNER SEPALS 4.0-6.5 mm. long, 2.8-3.2 mm. wide, ovate, acute, sometimes purplish. CAPSULE 3.5-6.0 mm. long, 3.0-4.5 mm. in diameter, ovoid-triquetrous, glabrous, 3-valved; each valve 3.0-4.5 mm. wide, ovate, acute. SEEDS 18-24, ovoid to laterally depressed or somewhat inequilateral, smooth and when moistened the membrane separable and the embryo visible.

CLEISTOGAMOUS FLOWERS: fruiting pedicels 1.0-4.2 mm. long, shorter to nearly as long as calyx, articulate. FRUITING CALYX 3.2-4.5 mm. long, 2.4-3.0 mm. in diameter, ovoid, sometimes with a distinct base. OUTER SEPALS (free portion) 1.2-3.0 mm. long, 0.2-0.4 wide, linear; INNER SEPALS 3.2-4.5 mm. long, 2.2-2.8 mm. wide, ovate, acute, sometimes purplish. STAMENS 4-5. CAPSULE 2.4-4.5 mm. long, 2.4-3.2 mm. in diameter,

ovoid-triquetrous, glabrous, rarely exceeding the calyx in length, 3-valved; each valve 2.4-3.2 mm. wide, ovate, acute. SEEDS 4-8, similar to the seeds of the chasmogamous flowers.

FLOWERING: June-October. HABITAT: Dry hillsides, pine-oak forest, moist meadows, and mountain summits. DISTRIBUTION: eastern Sonora into Chihuahua and southward in scattered localities into Guanajuato; also occurring in Guatemala and Honduras. (Map 13.)

A few specimens examined during this study varied conspicuously from the typical plants which are herbaceous, erect and tall, and have numerous ascending branches. These few variants were dwarf plants possessing shorter internodes, smaller leaves, and whose crowded flowers are mostly borne on shorter pedicels than those of the typical plants. However, plants having intermediate characters between the two extremes have been encountered and were even mounted on the same herbarium sheet. A few other specimens (some from Mexico and all those collected from Guatemala and Honduras) were suffruticose but most had received stem injury.

REPRESENTATIVE SPECIMENS: MEXICO: CHIHUAHUA: Majalca, 18-20 Aug. 1935, *LeSueur* (ARIZ, F, GH, MO, SMU, TEX, UC); El Cima, *LeSueur* 795 (F, TEX); pine plains, base of the Sierra Madre, *Pringle* 1186 (F, GH, MIN, MSC, ND, NY, RSA, UC, US); Mesa, west of Hop Valley, Sierra Madre Mts., 17 Sept. 1903, *Jones* (DS, UC); Loreto, Rio Mayo, *Gentry* 2578 (ARIZ, F, GH, MO, UC); Summit Sta. Clara Mts., *Shreve* 7949 (ARIZ, F). DURANGO: 20 mi. w. of Durango, *Waterfall* 12580 (OKLA); El Fuerte, on railroad west of Durango, *Pennell* 18247 (F); Otinapa, *Palmer* 442 (GH). GUANAJUATO: Dolores Hidalgo-Guanajuato Rd., *Kenoyer* 2138 (GH). SONORA: region of the Rio de Bavispe, *White* 3434 (GH, MICH, PH), *White* 4406 (ARIZ, GH, MICH), *White* 3513 (ARIZ, MICH), *White* 4262 (MICH). ZACATECAS: road to Huejuquilla el Alto, Jal., *McVaugh* 17745 (MICH). GUATEMALA: QUICHÉ: between Quiché & San Pedro Jacopilas, *Standley* 62459 (F); HUEHUETENANGO: hills east of Aguacatán *Standley* 62555 (F); Malacatán, *Smith* 3286 (GH). HONDURAS: EL PARAÍSO: moist meadow, south of Guinope, *Standley* 14863 (F); about 2 mi. nw. of Guinope, *Williams & Molina R.* 11524 (F); Cumbre northwest of Guinope, *Standley et al* 2023 (F), *Standley et al* 2115 (F). MORAZÁN: Tanque, *Rodriguez* 859 (F); Zamorano, *Rodriguez* 2166 (F).

17. *Helianthemum chihuahuense* S. Wats.

Helianthemum chihuahuense S. Wats., Proc. Am. Acad. 23: 268. 1888.

Type: *Pringle 1187*, October 1887. (GH!). Isotypes: (DS, F, MIN, NY, US!). "On pine plains at the base of the Sierra Madre, Chihuahua."

Halimium chihuahuense (S. Wats.) Gross., *Pflanzenreich* 14 (IV. 193): 45. 1903.

Heteromeris chihuahuensis (S. Wats.) Ponzo, *Nuovo Gior. Bot. Ital.* n.s. 28: 169. 1921. (No basionym cited.)

Suffruticose perennial, 11-32(45) cm. tall with few to numerous stems arising from a woody caudex (or rarely from subterranean rootstock). STEMS sometimes decumbent, usually ascending to erect, covered with stellate pubescence intermixed with simple villous hairs (about 1.0-1.5 mm. long). CAULINE LEAVES sessile or with petioles up to 1 mm. long; blade 7-22 mm. long, 2.0-7.5 mm. wide, elliptic or sometimes elliptic-oblongate, densely covered on both surfaces with both short stellate pubescence and simple villous hairs 0.5-1.5 mm. long (the stellate tomentum decreases as the leaf ages and hence the lower leaves sometimes appear lustrous with only villous hairs on both sides), sometimes tinged with purplish color; midvein conspicuous and elevated beneath, secondary veins obscure beneath; (usually with small and numerous fasciculate leaves in the axil of the principal ones; those often persisting throughout the season). FLOWERS: dimorphic with the chasmogamous and cleistogamous usually borne upon different branches. Chasmogamous flowers few, glomerate or sometimes in a racemose cyme terminating the main stem and sometimes the major branches. Cleistogamous flowers 1-few, glomerate at the end of the branches (sometimes appearing in the axils of the leaves). Pedicel and calyx covered with minute stellate pubescence and intermixed with simple villous hairs 0.5-1.5 mm long. Bracts 1.5-5.4 mm. long, 0.2-0.6 mm. wide, linear.

CHASMOGAMOUS FLOWERS: pedicels 4-5 mm. long. OUTER SEPALS (free portion) 1.6-3.0 mm. long, 0.3-0.4 mm. wide, linear; INNER SEPALS 5.5-7.0 mm. long, 2.4-3.0 mm. wide, ovate, acute to acuminate. PETALS 7-10 mm. long, 5-6 mm. wide, obovate. STAMENS 24-30. PISTIL c. 1.8 mm. long, ovary c. 1.2 mm. long, c. 0.9 mm. in diameter, ovoid, glabrous; style 0.5-0.8 mm. long; stigma c. 0.6 mm. wide, capitate. FRUITING PEDICELS up to 10 mm. long, articulate. FRUITING CALYX 6-8 mm. long, 2.8-3.5 mm. in diameter, ovoid. OUTER SEPALS (free portion) c. 3 mm. long, c. 0.4 mm. wide, linear; INNER SEPALS 6-8 mm. long, 3-4 mm. wide, ovate, acute to acuminate. CAPSULE c. 6 mm. long, c. 4 mm. in diameter, ovoid-triquetrous, glabrous, 3-valved; each valve c. 4 mm. wide, ovate, acute. SEEDS: none seen.

CLEISTOGAMOUS FLOWERS: fruiting pedicels 1.6-5.0 mm. long, articulate. OUTER SEPALS (free portion) 1.2-3.6 mm. long, 0.2-0.4 mm. wide, linear; INNER SEPALS 3.6-5.6 mm. long, 2.4-3.2 mm. wide, ovate, acute to acuminate. STAMENS 5-6. CAPSULE 2-5 mm. long, 1.6-3.2 mm. in diameter, ovoid-triquetrous, glabrous, 3-valved; each valve 1.6-3.2 mm.

wide, ovate, acute. SEEDS (2)4-11, inequilateral, smooth, when seeds moistened the membrane separable and the embryo visible.

FLOWERING: June-October. HABITAT: pine-oak forest and wooded hillside. DISTRIBUTION: southwestern Chihuahua and southern Durango, and Hidalgo; also known from Guatemala, Honduras and Costa Rica. (Map 14.)

The simple, villous cauline hairs, the suffruticose habit, the obscure secondary veins on the lower surface of the cauline leaves, and the small fasciculate axillary leaves that persist on the plant long after the principal leaves have fallen are all features which in combination would readily distinguish this species from other American species of *Helianthemum*.

Helianthemum Pringlei is the only species included in this study whose leaves, when villous, strongly suggest those of *H. chihuahuense*. But although the flowers of both *H. Pringlei* and *H. chihuahuense* are dimorphic, they differ in arrangement. The chasmogamous flowers of *H. chihuahuense* are borne at the end of the main stem and sometimes the major branches, while its cleistogamous flowers are solitary or glomerate at the end of the branches; in *H. Pringlei* the dimorphic flowers are borne together at the end of the main stem and branches. The habit of *H. chihuahuense* is suffruticose while that of *H. Pringlei* is usually herbaceous. The cauline leaves of *H. chihuahuense* have small fasciculate leaves in their axil and this is rare indeed in *H. Pringlei*.

South of Mexico *H. chihuahuense* has been often mistakenly identified as *H. glomeratum*, but the latter species lacks the simple villous hairs and its chasmogamous flowers differ in being usually solitary at the end of the branches and branchlets and decidedly overtop the glomerate, cleistogamous ones.

REPRESENTATIVE SPECIMENS: MEXICO: CHIHUAHUA: Vicinity of Areponapuchic, slopes of Barranca de Urique, *Knoblock 1312* (MICH, MSC); Memelichi, Rio Mayo, *Standley 2791* (F); base of Sierra Madre, *Pringle 1187* (DS, F, GH, MIN, ND, NY, RSA, US). DURANGO: Coyotes, Sierra Madre Occidental, *Pennell 18269* (PH); 6 mi. southwest of El Salto, *Waterfall 15486* (OKLA, SMU). HIDALGO: Trinidad, *Pringle 11880* (GH). GUATEMALA: CHIMALTENANGO: near San Martin, Jilotepeque, *Standley 64392* (F); HUEHUETENANGO: Sierra de los

Cuchumatanes above Chiantla, *Standley* 65609 (F); 10 km. e. of Huehuetenango, *Standley* 82067, 82085, & 82117 (F); nw. of Malacatancito, at km. 8 of the highway from Huehuetenango, *Standley* 82220 (F, GH); along trail between San Juan Atitlán & San Sebastian, Sierra de Cuchumatanes, *Steyermark* 52043 (F). JALAPA: Between Guisiltepeque & Potrero Carrillo, *Steyermark* 33026 (F, GH); QUICHÉ: along road south of Chichicastenango, *Standley* 62364 (F). SOLOLÁ: Volcan San Pedro, north facing slopes towards Lago de Atitlán, *Steyermark* 47191 (F). TOTONICAPÁN: along road between San Francisco and El Alto Momostenango, *Standley* 83983 (F). HONDURAS: MORAZÁN: slopes of Cerro de Uyuca, region of El Valle Encantado, *Standley et al* 947 (F), *Standley & Williams* 104 (F); Hoya Grande, along road between El Zamorano & Suyapa, *Standley & Williams* 1432 (F); near Hoya Grande, drainage of the Rio Yeguaré, *Williams & Molina R.* 13278 (GH), *Williams & Molina R.* 10993 (GH, MO, MICH); Zamorano, *Rodriguez* 554 (F), *Rodriguez* 618 (F). COSTA RICA: Los Friales, *Valerio* 1371 (F).

18. *Helianthemum glomeratum* (Lag.) Lag. ex Dunal

Cistus glomeratus Lag., Gen. et Sp. Nov. 16. 1816. Type: not seen. "prope Acapulco et Cimapan in Nova Hispania."

Trichasterophyllum hyssopifolium Link, Jahr. Gewächskunde 3: 69. 1820. nom. nud., cited in synonymy by Grosser.

Helianthemum glomeratum (Lag.) Lag. ex Dun., Prodr. 1: 269. 1824.

Helianthemum obcordatum Moç. & Sessé ex Dun., Prodr. 1: 284. 1824.

Type: MA on loan to F! "In Mexico."

Heteromeris mexicana Spach, Ann. Sci. Nat. 2nd ser. 6: 370. 1836.

Helianthemum glomeratum "Lag." cited as a questionable synonym; descr. Spach, Hist. Nat. Vég. Phanér. 6: 104. 1838. Type: not seen. "Cette plante croît au Mexique; nous l'avons décrite d'après des échantillons de l'herbier de M.P.B. Webb, les uns trouvés par M. Andrieux à Toluca, les autres envoyés par Pavon sous le nom de *Cistus mexicanus*, sans indication précise de localité."

Taeniostema micranthum Spach, Ann. Sci. Nat. 2nd ser. 6: 371. 1836. nom. nud.; descr. Spach, Hook. Comp. Bot. Mag. 2: 289. 1836 [1 May 1837]. Type: not seen. *Helianthemum glomeratum* cited as questionable synonym in Annales and as a synonym in the Histoire. "I have described it from dried specimens of plants cultivated in the Jardin des Plantes at Paris."

Cistus Mexicanus Sessé & Moç., Pl. Nov. Hisp. 180. 1894. Type: MA?, not seen. "ad Oppidum S. Rosae, prope Guanaxuatum."

Halimium glomeratum (Lag.) Gross., Pflanzenreich 14 (IV. 193): 47. 1903.

Heteromeris glomerata (Lag.) Ponzo, Nuovo Gior. Bot. Ital. n.s. 28: 169. 1921. (No basionym cited.)

Crocanthemum glomeratum (Lag.) Janchen, Nat. Pflanzenfam. ed. 2. 21: 305. 1925.

Suffruticose perennial, 1.0-5.5 (8.0) dm. tall with few to many stems arising from a woody, branched caudex and occasionally spreading by a horizontal, woody stem up to 1.5 dm. long. STEMS ascending to erect, stellate-tomentose, becoming glabrate and with numerous branches and ultimate branchlets. LEAVES on the current season's growth sessile to subsessile or with petiole up to 2 mm. long (if so, secondary veins prominent beneath); blade 1.0-2.5 (3.5) cm. long, 2-6 (14) mm. wide; oblanceolate or rarely elliptic to obovate, hoary and stellate-tomentose on both surfaces; midvein mostly prominent and secondary veins obscure or very slightly elevated or prominent beneath; base of blade attenuate, apex rarely obtuse, subacute to acute; margin entire, nonrevolute. FLOWERS: dimorphic (chasmogamous and cleistogamous) but rarely with only cleistogamous flowers and lacking the chasmogamous ones, or with chasmogamous and but very few cleistogamous ones. Chasmogamous flowers (mostly solitary) at the tip of the branches and branchlets, borne on filiform pedicel (1.5) 2-3 times longer than calyx and overtopping the subsessile cleistogamous flowers. Cleistogamous flowers sub-sessile in axillary and terminal glomerules. Bracts 1.6-5.0 mm. long, 0.2-0.8 mm. wide, linear to oblanceolate, few to very numerous. Pedicel and calyx stellate-tomentulose.

CHASMOGAMOUS FLOWERS: pedicels (7) 10-20 mm. long, (1.5) 2-3 times longer than calyx. OUTER SEPALS (free portion) 0.6-4.0 mm. long, 1/5-2/3 the length of the inner sepals, 0.2-0.4 mm. wide, linear; INNER SEPALS 3-7 mm. long, 1.8-3.2 mm. wide, ovate or ovate-lanceolate, acute or acuminate, sometimes with somewhat elevated veins at the back. PETALS 4-9 mm. long, 3.5-6.0 mm. wide, obovate, "pale yellow with slight orange flush at base." [Ball 4449 GH!] STAMENS 20-34. PISTIL 1.2-2.4 mm. long; ovary 0.6-1.6 mm. long, 0.5-0.9 mm. in diameter, ovoid, glabrous; style 0.5-1.0 mm. long; stigma 0.3-0.7 mm. wide, capitate. FRUITING CALYX 4.5-7.5 mm. long, 2.6-4.5 mm. in diameter, ovoid. CAPSULE 3.5-4.5 mm. long, 2-3 mm. in diameter, ovoid-triquetrous, glabrous, 3-valved; each valve 2-3 mm. wide, ovate, acute, slightly concave. SEEDS (6) 10-20, ovoid, somewhat depressed on both sides to inequilateral, slightly pebbled, with thin separable membrane and the embryo becoming visible when seeds moistened.

CLEISTOGAMOUS FLOWERS: subsessile. FRUITING PEDICELS 0.3-3.6 mm. long, shorter than calyx. FRUITING CALYX 2.4-5.0 mm. long, 2-3 (4) mm. in diameter, ovoid, sometimes with yellowish base. OUTER SEPALS (free portion) 0.6-3.0 mm. long, 0.2-0.4 mm. wide, linear; INNER SEPALS 2.4-5.0 mm. long, 1.2-3.6 mm. wide, ovate or ovate-lanceolate, acute or acuminate. STAMENS 3-6. CAPSULE 1.6-3.6 mm. long, 1.2-2.4 (3.0) mm. in diameter, ovoid-triquetrous, glabrous, 3-valved; the valves 1.2-2.4 (3.0) mm. wide, ovate, acute, slightly concave. SEEDS (1) 2-7 (11), similar to those of the chasmogamous flowers.

FLOWERING: throughout the year. HABITAT: grassland with scattered pine or oak or in open forests or on dry rocky hills. DISTRIBUTION: southwestern Texas, southern Baja California southward into Guatemala. (Map 15.)

Helianthemum glomeratum has a wide distribution and has been more extensively collected than any other species of the genus found in Mexico or Central America. This is the only species mainly restricted to Mexico and Guatemala which extends northward in the United States. It is found in the Chisos Mountains of Brewster Co., Texas.

The suffruticose habit and the densely glomerate, nearly sessile, cleistogamous flowers, often overtopped by the chasmogamous flowers possessing pedicels (1.5)2-3 times longer than its calyx, are characteristics which taken collectively readily distinguish this species from all American species of *Helianthemum*.

This species exhibits a remarkable variation in foliage, flowers, fruits and seeds. The foliage differs in blade size, length of petiole and extent of elevation of the secondary veins on the lower surface of the blade. The flowers differ in both kind and quantity; some specimens have both chasmogamous and cleistogamous ones, and still other plants have cleistogamous flowers only. The fruits, especially those derived from the cleistogamous flowers, differ greatly in size and number of seeds. This variation appears to be nearly continuous.

Following his two segregate genera, Spach listed two new species, *Heteromeris mexicana* and *Taeniostema micranthum*. For both of these species *Helianthemum glomeratum* was cited as a questionable synonym. *Heteromeris mexicana* was based upon specimens with both chasmogamous and cleistogamous flowers. Spach's (Hist. Nat. Vég. Phanér. 6: 104. 1838.) account of the latter species leaves no doubt that *Helianthemum glomeratum* was the plant being described. *Taeniostema micranthum* was based on specimens with cleistogamous flowers only. Spach (Hist. Nat. Vég. Phanér., 6: 104. 1838.), however, equated the latter species with *Helianthemum glomeratum*.

REPRESENTATIVE SPECIMENS: UNITED STATES: TEXAS: Brewster Co., top of Mt. Emory, Chisos Mts., *Warnock 20976* (TEX); Flat Top Mountain, Chisos Mountains, *Warnock 1116* (US). MEXICO: AGUASCALIENTES: road to Calvillo, 18 mi. west of Aguascalientes, *McVaugh & Koelz 114* (MICH). Sur Baja California: La Laguna, Sierra Laguna, *Gentry 4378* (ARIZ, DS, GH). CHIAPAS: Tstapa an sonnigen Hanger, *Seler 2086* (F, GH). CHIHUAHUA: Santa Eulalia Mts., *Pringle 300* (F, GH, MICH, PENN, RSA). DURANGO: Santiago Papasquiario, *Palmer 56* (F, GH, UC). FEDERAL DISTRICT: lava fields near Eslaba, *Pringle 11371* (F, GH, SMU). GUANAJUATO: Puerto Nieto near San Miguel Allende, *Kenoyer 2049* (GH). GUERRERO: west of Chilpancingo, *Richands et al 3353* (SMU). HIDALGO: Trinidad, *Pringle 11881* (GH). JALISCO: hillside above Etzatlán, *Pringle 11372* (F, GH, MSC, SMU); hills near Guadalajara, *Pringle 2361* (ARIZ, F, GH, MSC, NY, PH, RSA, UC); San Sebastián, w. to Mascota, *Mexia 1414* (DS, F, GH, MICH, MIN, UC). MEXICO: Dist. Temascaltepec, *Hinton 3033* (F, UC), *Hinton 8401* (F, GH), *Hinton 8990* (DS, F, ILL, MICH, SMU, TEX), *Hinton et al 2720* (UC), *Hinton et al 8916* (ARIZ, F, GH, TEX). MEXICO-PUEBLA: Ixtaccihuatl, *Purpus 1815* (F, UC). MICHOACÁN: grassy hillslopes, Zitacuaro-Las Cañas, Dist. Zitacuaro, *Hinton et al 13548* (F, ILL, MICH, UC); Tancitaro, Dist. Uruapan, *Hinton et al 15733* (ARIZ, GH, TEX). MORELOS: Cuernavaca, *Kenoyer A467*. NAYARIT: Tepic, *Palmer 2017* (GH). NUEVO LEON: about 15 mi. sw. of Galeana, *Mueller & Mueller 980* (F, GH, MICH, TEX). OAXACA: Sierra de San Felipe, *Smith 809* (F). PUEBLA: San Manuel de la Sierra, Sierra Negra, *Balls B4449* (GH, UC). QUERETARO: 15 mi. se. of San Juan del Rio, *Waterfall 13978* (OKLA, SMU). SAN LUIS POTOSI: Alvarez, *Palmer 56* (F, GH, UC); near San Luis Potosi, *Palmer 35* (GH, UC). SINALOA: Sierra Monterey, *Gentry 5891* (ARIZ, DS, GH, MICH). SONORA: Alamos, *Palmer 342* (GH). TLAXCALA: Sta. Ana Chiantauapan, *Arsene 1738* (MO). ZACATECAS: Zacatecas, *Purpus 502* (POM, UC). GUATEMALA: CHIMALTENANGO: *Johnston 1773* (F). HUEHUETENANGO: Sierra de Los Cuchumatanes, above Chiantla, *Standley 65620* (F), *65604* (F); Rio Pucal, *Standley 65826* (F, GH, MICH). JALAPA: hills between Guisiltepeque and Potrero Carrillo, *Steyermack 33024* (F). QUEZALTENANGO: Cerro La Pedrera, south of Quezaltenango, *Standley 66460* (F). QUICHÉ: without exact locality, *Aguilar 1444* (F). SAN MARCOS: Slopes of Volcán Tajumulco, *Steyermack 36917* (F). ZACAPA: Sierra de Las Minas, *Steyermack 42754* (F, UC).

19. *Helianthemum rosmarinifolium* Pursh

Helianthemum rosmarinifolium Pursh, Fl. Am. Sept. 2: 364. 1814.

Type: "Enslen. July. v.s. in Herb. Enslen.", not seen; "In pine barrens, Georgia." not *Helianthemum rosmarinifolium* Presl, Symbolae Botanicae 1: 32. Tab. 21. 1832, which was from Palestine.

Heteromeris polifolia Spach, Hook. Comp. Bot. Mag. 2: 291. 1836

[1 May 1837]. Type: ". . . in the Province of Texas by Mr. Drummond (third collection, No. 20!), as also by M. Berlandier.", not seen. Isolectotype: *Drummond*, 3rd collection No. 20 (GH, NY!) and *Berlandier* (US-1169410!) also seen.

Anthelis (*Horanthes*) *podanisia* Raf., New Fl. N. Am. 3: 30. 1836 [1838].

Horanthes podanisia (Raf.) Raf., Sylva Tell. 133. 1838.

Helianthemum polifolium (Spach) T. & G., Fl. N. Am. 1: 151. 1838; not *Helianthemum polifolium* DC., Lam. & DC. Fl. Fr. 4 (2): 823. 1815.

Helianthemum capitatum Nutt. ex Engelm. & Gray, Bost. Journ. Nat. Hist. 5: 212. 1847. A substitute for the preoccupied *Helianthemum polifolium* (Spach) T. & G.

Halimium rosmarinifolium (Pursh) Gross., Pflanzenreich 14 (IV. 193): 49. 1903.

Halimium domingense Urb., Symb. Ant. 7: 286. 1912. Type: *von Tuerckheim 3430*, not seen. Isotype: *von Tuerckheim 3430* (NY!). "in Sto. Domingo prope Constanza in Valle nuevo, 2200 m."

Halimium stenophyllum Urb., Symb. Ant. 7: 524. 1913. Type: *Fuertes 1919*, not seen. Isotypes: *Fuertes 1919* (NY, US!). "in Sto. Domingo prov. Azua ad Las Cañitas 1400 m. alt."

Crocanthemum domingense (Urb.) Janchen, Nat. Pflanzenfam. ed. 2. 21: 305. 1925.

Crocanthemum stenophyllum (Urb.) Janchen, Nat. Pflanzenfam. ed. 2. 21: 305. 1925.

Crocanthemum rosmarinifolium (Pursh) Janchen, Nat. Pflanzenfam. ed. 2. 21: 307. 1925.

Perennial herb (13)20-40(51) cm. tall with several stems arising from a woody caudex. STEMS ascending to erect, stellate-tomentose, with numerous ascending branches. BASAL LEAVES sometimes present, if so, 10-22 mm. long, 3-5 mm. wide, obovate. CAULINE LEAVES: petiole 1-4 mm. long; blade (4.5) 14-38(48) mm. long, 5-14 times as long as wide, (0.7)2.3-5.2(7.8) mm. wide, oblanceolate to elliptic to linear-lanceolate, green and stellate-pubescent above, hoary and stellate-tomentose beneath; midvein elevated and secondary veins but slightly elevated beneath; base of blade attenuate, apex subacute to acute; margin entire, somewhat revolute. FLOWERS: dimorphic (both chasmogamous and cleistogamous). Chasmogamous flowers solitary at the tip of the main branches borne on filiform pedicel (2-3 times longer than calyx) overtopping the subsessile, cleistogamous flowers. Cleistogamous flowers subsessile in axillary and terminal glomerules. Bracts up to 2 mm. long and c. 0.3 mm. wide, linear. Pedicel and calyx stellate-tomentose.

CHASMOGAMOUS FLOWERS: pedicels 10-22 mm. long, 2-4 times longer than calyx. OUTER SEPALS (free portion) 1.3-2.0(2.5) mm. long, 0.2-0.3 mm. wide, linear; INNER SEPALS 2.5-4.3 mm. long, 1.3-2.0 mm. wide,

ovate, acute and slightly oblique. PETALS 4-5 (6.4) mm. long, 3.6-4.8 (5.4) mm. wide, yellow, obovate. STAMENS 15-24. PISTIL 0.8-1.5 mm. long; ovary 0.5-1.0 mm. long, 0.4-0.7 mm. in diameter, ovoid, glabrous; style 0.3-0.4 mm. long; stigma c. 0.3 mm. wide, capitate. FRUITING CALYX: 2.5-4.5 mm. long, 1.5-3.0 mm. in diameter, ovoid to nearly pyriform, with somewhat yellowish base. CAPSULE 2-3 mm. long, 1.4-1.8 mm. in diameter, ovoid, glabrous, 3-valved; each valve 1.0-1.4 mm. wide, ovate-elliptic, acute, separating to the middle at maturity. SEEDS 1-3 (6), ovoid or somewhat appressed on both sides to inequilateral, smooth and when moistened with a thin separable membrane and then the embryo visible.

CLEISTOGAMOUS FLOWERS: subsessile. FRUITING PEDICELS 0.5-3.0 mm. long. FRUITING CALYX 1.5-1.8 mm. long, 1.2-1.5 mm. in diameter, somewhat obovoid with yellowish base. OUTER SEPALS (free portion) 0.5-1.0 mm. long, c. 0.2 mm. wide, linear; INNER SEPALS 1.5-1.8 mm. long, 1.0-1.5 mm. wide, ovate, acute. STAMENS 3-5. CAPSULE 1.3-1.7 mm. long, 1.0-1.3 mm. in diameter, somewhat obovoid, glabrous, 3-valved; each valve 0.8-1.0 mm. wide, somewhat obovate, subacute, separating to the middle at maturity. SEEDS 1 (2), similar to those of the chasmogamous flowers.

FLOWERING: May-July. HABITAT: open sandy pinelands, sandhills, and fields. DISTRIBUTION: North Carolina southward into northern Florida and westward into the eastern half of Texas; also found in the West Indian Island of Santo Domingo. (Map 3.)

Helianthemum rosmarinifolium can be readily recognized by its solitary chasmogamous flowers borne at the top of the main branches on filiform pedicels 2-4 times longer than the calyx at anthesis, its cleistogamous capsules less than 1.5 mm. in diameter with the valves separating only to the middle, and the midcauline leaves 5-14 times as long as wide.

In spite of differences in habit and foliage, this taxon appears most closely related to *H. glomeratum*. Both of these taxa possess terminal, solitary, chasmogamous flowers on filiform pedicels 2-4 times longer than their calyces, overtopping the subsessile cleistogamous flowers which occur in axillary and terminal glomerules. The fruit and associated sepals derived from the cleistogamous flowers are quite variable in *H. glomeratum* and even one of its races approaches those of *H. rosmarinifolium* in shape and size of calyx, number of seeds, and seed characteristics.

Helianthemum argenteum is similar to *H. glomeratum* and *H. rosmarinifolium* in having solitary, terminal, chasmogamous flowers on filiform pedicel (1) 1.5-2 times longer than the calyx. But it can be readily distinguished by its decumbent habit and its silvery pubescence. The axillary, sessile to subsessile, solitary (rarely two) cleistogamous flowers in the axil of the narrow (1.2 mm. wide or less) sessile leaves also serve to make it readily separable.

Although neither the type of the species nor a photograph of it has been available in this study, the original description seems sufficiently diagnostic to make it certain that this is the plant that Pursh described as *H. rosmarinifolium*.

This species has previously been considered endemic to the southeastern United States. However, Urban (Symb. Ant. 7: 286. 1912.) described a supposedly new species collected from the West Indies (Santo Domingo) naming it *Halimium domingense*. One year later, Urban (Symb. Ant. 7: 525. 1913.) proposed another species as new from the same general area, calling it *Halimium stenophyllum*.

The isotypes of both of Urban's species, *Halimium domingense* (NY!) and *Halimium stenophyllum* (NY! US!), were studied, and in spite of the geographical isolation, no difference could be found except that the Dominican specimens are not quite so erect as specimens collected in the United States. Therefore both of Urban's proposed species are here treated as synonyms of *H. rosmarinifolium*. This is the only species of *Helianthemum* known from the West Indies. The distribution of *Sabatia calycina* (Lam.) Heller is rather similar as both species range throughout the southern Coastal Plain and reappear in central Hispaniola. This *Helianthemum* is not known from peninsular Florida while the *Sabatia* ranges well into the peninsula and is known also from the Oriente Province of Cuba.

REPRESENTATIVE SPECIMENS: NORTH CAROLINA: Richmond Co., roadside, Hoffman, *Gupton 1610* (NCU). SOUTH CAROLINA: Berkeley Co., Gravel Hill Lake, ene. of Bonneau, *Ahles 30788* (DUKE, NCU); Edgefield Co., 3 mi. ene. of Trenton, *Radford 26416* (DUKE, NCU). GEORGIA: Baker Co., 10 mi. sw of Newton, *Thorne 4512* (GA, IA, CU); Candler Co., 10 mi. n. of Metter, 25 June 1950, *Sargent* (GH, KANU,

MIN, NCSC, OKL, WIS, WVA); Decatur Co., near Bainbridge, *Curtiss 6477* (DS, F, GH, ILL, ISC, MIN, MO, NY, SMU, UC, US); McIntosh Co., along the Altamaha River near Darien, *Correll 5470* (DUKE, GA, NCSC, TENN); Screven Co., Oliver, *Curtiss 6838* (CU, GH, ILL, MIN, MO, NY). FLORIDA: Gadsden Co., without exact locality, *Boomhour 627* (DUKE). MISSISSIPPI: Clarke Co., De Soto, *Mohr* (NY, US); Lowndes Co.: Columbus, *Mohr* (MO, NY). ARKANSAS: Drew Co., Wilmar, *Demaree 24526* (SMU); Johnson Co., Piney, *Palmer 8162* (MO, PH, US). OKLAHOMA: Marshall Co., Lake Texoma, *Goodman 7044* (DUKE, OKL). TEXAS: Bastrop Co., about 5 mi. s. of Bastrop, *Lundell & Lundell 8975* (DS, GH, MICH, NY, SMU); Brazos Co., Bryan, *Palmer 7796* (MO, NY, US); Dallas Co., near Dallas, *Curtiss 228* (CU, F, GH, KANU, MICH, MIN, NY, OKL); Tarrant Co., without exact locality, *Ruth 496* (CU, F, GH, ILL, ISC, MICH, MSC, NY, PH, SMU, US, WIS); Waller Co., Hempstead, *Hall 30* (F, MO, NY, US). SANTO DOMINGO: Prope Constanza in Valle nuevo, 2200 m., *Tuerckheim 3430* (NY); prov. Azua ad Las Caffitas 1400 m. alt., *Fuertes 1919* (NY, US).

20. *Helianthemum argenteum* Hemsl.

Helianthemum argenteum Hemsl., Diagn. Pl. Nov. Mex. et Centr.-Amer. part 2: 20. 1879. Type: *Parry & Palmer 29*. (K) Isotypes: (GH, NY, US!) "Mexico: in regione San Luis Potosi, alt. 6000-8000 ped."

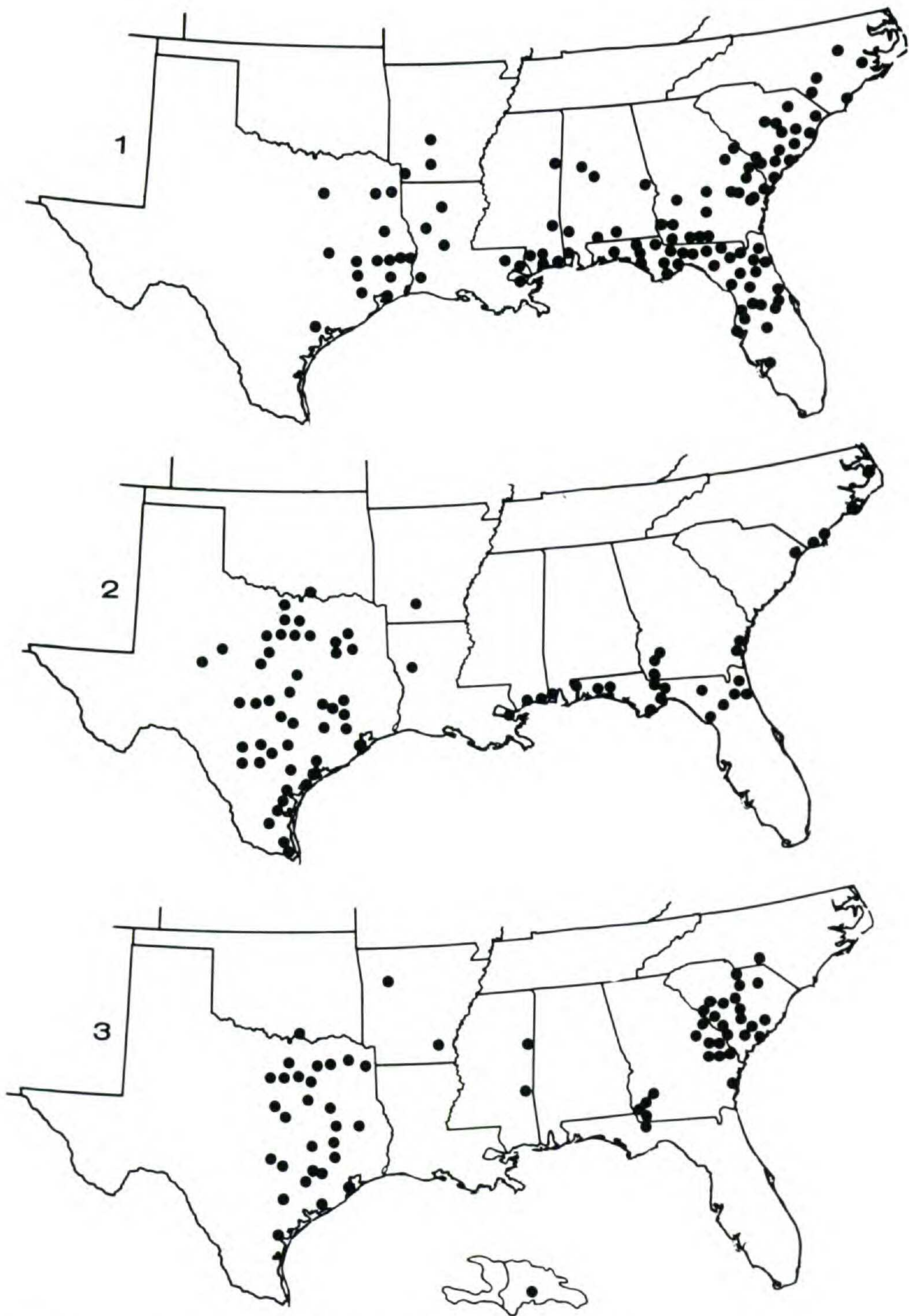
Halimium argenteum (Hemsl.) Gross., Pflanzenreich 14 (IV. 193): 47. 1903.

Heteromeris argentea (Hemsl.) Ponzio, Nuovo Gior. Bot. Ital. n.s. 28: 170. 1921. (No basionym cited.)

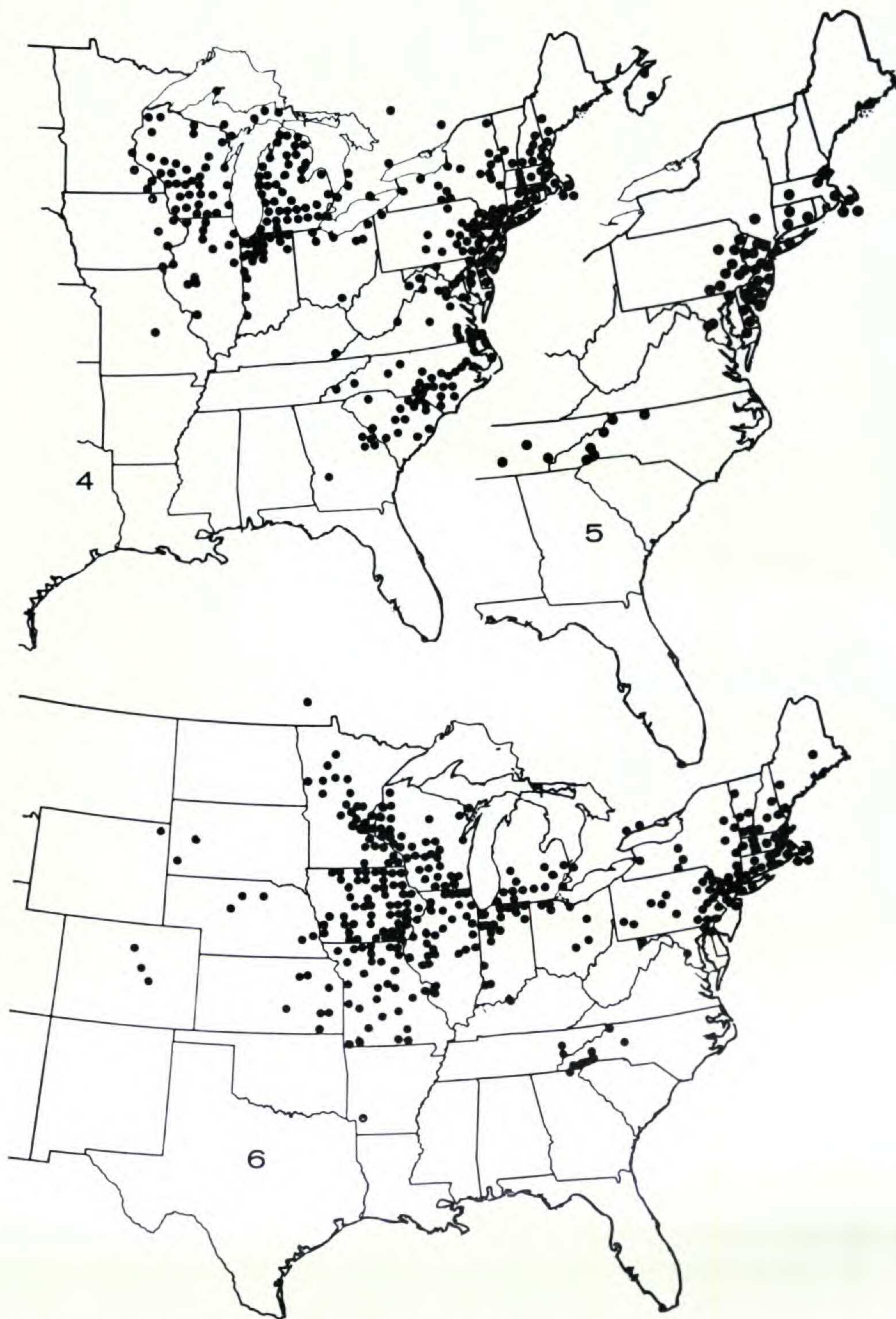
Crocanthemum argenteum (Hemsl.) Janchen, Nat. Pflanzenfam. ed. 2. 21: 305. 1925.

Suffruticose perennial, 5-15 cm. tall, arising from a thick woody root. STEMS short, erect, with numerous, decumbent to erect branches clothed with fine, silvery, appressed elongate tomentum. LEAVES (on the current season's growth) estipulate but with smaller leaves in their axil, sessile; blade 5-7 mm. long, 0.8-1.2 mm. wide; narrowly elliptic to linear, densely covered with fine, silvery, appressed elongate tomentum on both surfaces; midvein but slightly elevated and secondary veins obscure beneath; base of blade somewhat attenuate, apex acute to pointed and somewhat lustrous; margin entire, non-revolute. FLOWERS dimorphic (both chasmogamous and cleistogamous): the chasmogamous solitary at the end of the branches (mostly accompanied by two sessile cleistogamous flowers) borne on pedicel (1) 1.5-2 times longer than calyx. Cleistogamous flowers solitary (sometimes two together), sessile in the leaf axil. Pedicel and calyx covered with fine, silvery, depressed elongate tomentum.

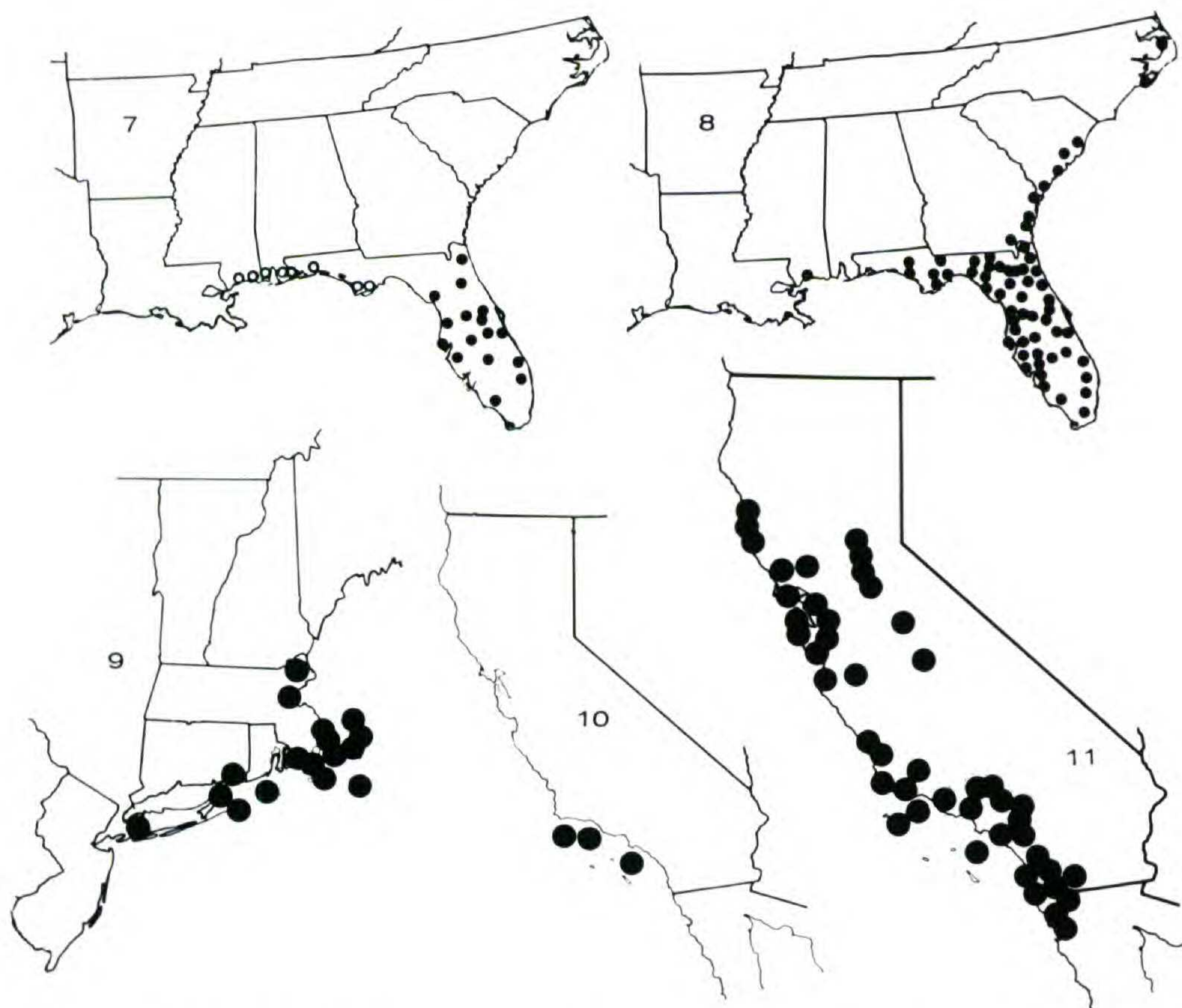
CHASMOGAMOUS FLOWERS: Pedicels 5-7 mm. long. OUTER SEPALS (free portion) 1.5-2.0 mm. long, about half the length of the inner sepals,



Maps 1-3. Map 1. *H. carolinianum*. Map 2. *H. georgianum*. Map 3. *H. rosmarinifolium* with inset of the island of Hispaniola.



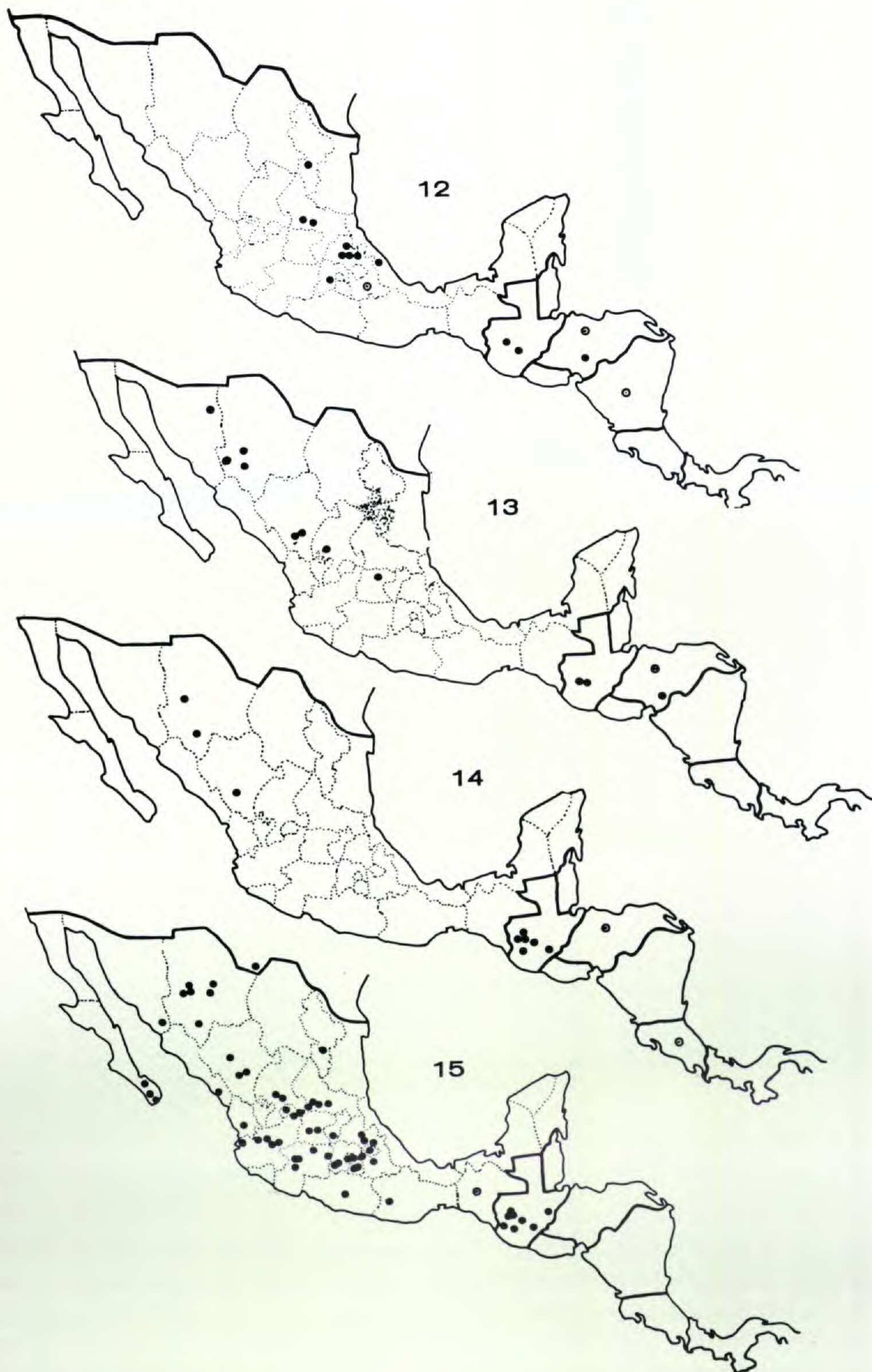
Maps 4-6. Map 4. *H. canadense*. Map 5. *H. propinquum*. Map 6. *H. Bicknellii*.



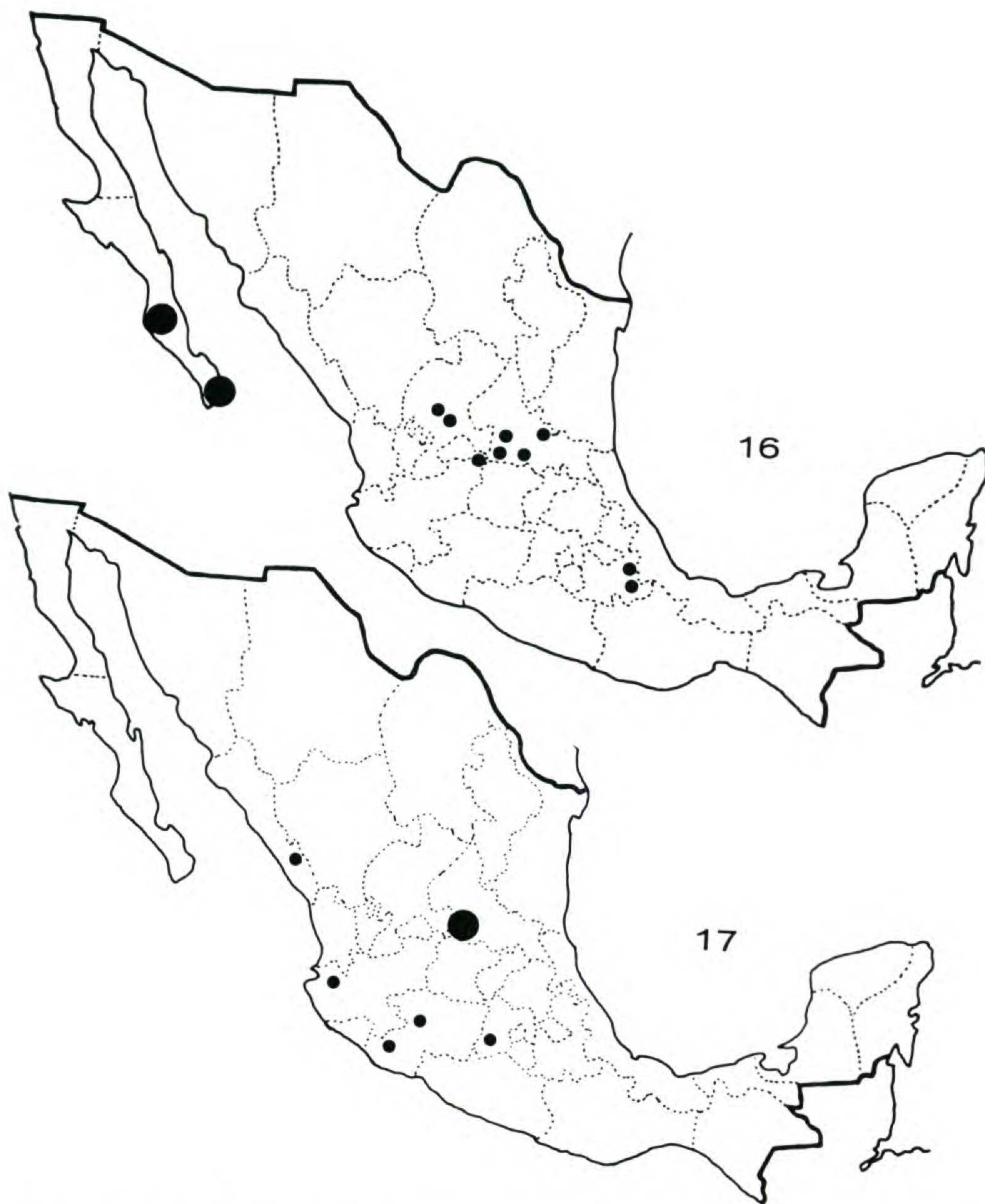
Maps 7-11. Map 7. *H. arenicola* (open circles) and *H. Nashii* (solid dots). Map 8. *H. corymbosum*. Map 9. *H. dumosum*. Map 10. *H. Greenei*. Map 11. *H. scoparium*.

0.3-0.4 mm. wide, linear; INNER SEPALS 3-4 mm. long, 1.2-1.6 mm. wide, ovate-lanceolate, acuminate. COROLLA yellow, petals 3-4.5 mm. long, 3.0-3.5 mm. wide, obovate. STAMENS 10-15. PISTIL 1.2-1.6 mm. long; ovary 0.8-1.2 mm. long, 0.4-0.5 mm. in diameter, narrowly ovoid; glabrous; style 0.1-0.2 mm. long; stigma about 0.2 mm. wide. FRUITING PEDICELS 7-10 mm. long. FRUITING CALYX narrowly ovoid. OUTER SEPALS (free portion) 1.5-2.5 mm. long, about half that of the inner, 0.3-0.4 mm. wide, linear; inner sepals 5.0-5.5 mm. long, 1.5-2.0 mm. wide, ovate-lanceolate, acuminate, about twice longer than wide. CAPSULE 3.6-4.0 mm. long, about twice as long as wide, 1.2-1.6 mm. in diameter, narrowly ovoid-triangular, glabrous, very thin-walled, 3-valved; each valve 1.2-1.6 mm. wide, ovate-lanceolate, acute, somewhat spreading at maturity. SEEDS 3, ovoid or nearly so, covered with white papillae borne on the thin separable membrane, the embryo visible when seed moistened.

CLEISTOGAMOUS FLOWERS: Sessile to subsessile. FRUITING PEDICELS up to 0.8 mm. long. FRUITING CALYX 2.8-3.6 mm. long, 1.4-1.7 mm. in



Maps 12-15. Map. 12. *H. Coulteri*. Map 13. *H. Pringlei*. Map 14. *H. chihuahuense*. Map 15. *H. glomeratum*. (Open circles on all maps indicate that the exact locality is unknown.)



Maps 16-17. Map 16. *H. nutans* (large dots) and *H. patens* (small dots). Map 17. *H. concolor* (small dots) and *H. argenteum* (large dot).

diameter, ovoid. OUTER SEPALS (free portion) 1.2-1.6 mm. long, about half the length of the inner sepals, 0.2-0.3 mm. wide, linear; INNER SEPALS 2.8-3.6 mm. long, about twice as long as wide, 1.0-1.4 mm. wide, ovate-lanceolate, acuminate. STAMENS 3. CAPSULE 1.2-1.4 mm. long, about twice longer than its diameter, 0.5-0.7 mm. in diameter, narrowly ovoid-triquetrous, very thin-walled, glabrous, 3-valved; each valve 0.5-0.7 mm. wide, ovate-lanceolate, acute. SEEDS 1-2, other characters similar to those of the chasmogamous seeds.

FLOWERING: June. HABITAT: rocky hillsides and summits. DISTRIBUTION: known only from the State of San Luis Potosi, Mexico. (Map 17, large dot).

Helianthemum argenteum is rare and has been little collected. Only three collections were seen by us. It is the only Mexican species of *Helianthemum* with the following combination of features: an elliptic-linear leaf blade, less than 1.5 mm. wide and 5-7 times longer than wide covered with depressed silvery pubescence and with solitary (or rarely two together) cleistogamous flowers which are sessile to subsessile in the leaf axil and whose chasmogamous flowers are solitary at the end of the branches.

SPECIMENS EXAMINED: MEXICO: SAN LUIS POTOSI: chiefly in the region of San Luis Potosi, *Parry & Palmer 29* (GH, NY, US); Cerro Tepetate, southwest of San Luis Potosi, *Pennell 17656* (PH), S. Miquelito Mts., *Schaffner 606* (PH).

DOUBTFUL AND EXCLUDED NAMES

Anthelis (*Horanthes*) *arenaria* Raf., New Fl. N. Am. 3: 31. 1836. [1838]; later *Horanthes arenaria* (Raf.) Raf., Sylva Tell. 133. 1838. The original description of Rafinesque's species is quoted here in full: "551 *Anthelis* (*Horanthes*) *arenaria* Raf. many procumbent stems nearly smooth. Leaves linear acute sometimes ciliate, pedicels axillary uniflore equal to leaves, 3 sepals membranaceous rufous smooth trinerve ovate acute, 2 linear subciliate — in sands of Pine barrens in South New Jersey and Florida, first discovered by Kin in 1801. Root large deep, many short diffuse stems, leaves small, flowers rather large."

There is not a single species of *Helianthemum* occurring in both "South New Jersey and Florida." However the following characteristics: ". . . leaves . . . sometimes ciliate . . . uniflore . . . in sands of Pine barrens in South New Jersey . . . flowers rather large" make it probable that Rafinesque was redescribing at least in part what was already known as *Helianthemum canadense* (L.) Michx.

Cistus Rosmarinifolius Moç. & Sessé, Fl. Mex. 130. 1894. Type: ? MA, not seen. "in oppido S. Andrés de el Valle haud procul Temascaltepec, ubi vulgo *Romerillo* audit."

Helianthemum astylum Moç. et Sessé ex Dunal, Prodr. 1: 284. 1824. Treated as a synonym of *Halimium glomeratum* (Lag.) Grosser (Pflanzenreich 14 (IV. 193): 47. 1903.) And previously Hemsley (Biol. Cent. Am. 1: 47. 1879) considered it a probable synonym of "one of the states of *H. glomeratum*."

Helianthemum tripetalum Moç & Sessé ex Dun., Prodr. 1: 284. 1824.

= *Lechea tripetala* (Moq. & Sessé ex Dun.) Britt. Bull. Torrey Club 21: 252. 1894.

Horanthes tripetala attributed by Merrill (Ind. Raf. 169. 1949.) to Raf., New Fl. N. Am. 3: 30. 1836 [1838]. who under the genus *Anthelis* and subg. *Horanthes* merely indicates that "*H. tripetala* of Mexico is probably a *Lechea*!" The "H." doubtless stood for *Helianthemum* and referred to the publication of Dunal cited above.

DEPARTMENT OF BOTANY, DUKE UNIVERSITY
DURHAM, NORTH CAROLINA

THE EXTENDED DISTRIBUTION OF *ERAGROSTIS* *TRACYI* FROM SANIBEL ISLAND, FLORIDA¹

A. S. Hitchcock in 1934 (1), based the description of *Eragrostis tracyi* on specimens of S. M. Tracy (no. 7168) collected on Sanibel Island, Florida, 1901. This endemic of narrow distribution was collected again from the type locality by George R. Cooley (no. 2608) (1954) (2). Since its discovery by Tracy in 1900, a period of 64 years, the species has been known only from Sanibel Island (3).

In 1964, the species was twice encountered in other localities. The 20th of April, collection no. 27403 was made on Mound Key, Estero Bay, Lee Co., only about 15 mi. southeast of Sanibel. Two pinkish plants 5 cm. tall, with basal branches and spreading panicles were growing in dry, compacted soil of the wooded trailside on the top of the Mound. They were the only ones available; pressure of time prevented wider search.

The 6th of October a population was found on Longboat Key, Sarasota Co., about 60 mi. north of Sanibel; collection no. 27566. It is established on a low terrace of the Gulf of Mexico on an extensive shell-beach with a remarkable association of *Sabal palmetto*, *Agave decipiens* and *Juniperus silicicola*. Frequency and size of the shrubs in the undergrowth give the appearance of a primary condition, or at

¹Contribution 19, Botanical Laboratories, University of South Florida.